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TAKING CARE OF THE OPERATOR.

OUR leading article this month shows another phase of the big telephone company's care of its operators. It tells how the girls who are attacked by tuberculosis (and there is always a certain percentage of such cases where so many are employed), are nursed back to health by the most approved methods of modern science, at the company's expense.

Telephone operating is not an occupation that breeds tuberculosis. In the sedentary classification its health average is high; for the surroundings are hygienic, the inspection rigid and the work nicely adjusted. The number of cases developed as a result of working conditions is practically nil. But the company cannot regulate the homes of its operators. It can only strive to undo the harm that is done outside its jurisdiction.

The work of the Chicago Telephone Company at the Naperville Sanitarium is intensely interesting from a humanitarian standpoint—perhaps the most interesting of all the things the company does for its operators. But it is only one of many similar efforts. TELEPHONE ENGINEER has told, in previous articles, how the rest rooms are equipped and how they are used; about the gardens and playgrounds in yards and on roofs; of the libraries and lunch rooms and gymnasiums. And the Chicago Telephone Company is by no means peculiar in this. Practically every operating telephone company, within its means, is doing all it can to make the lot of the girl operator a happy one.

And the operators are responding nobly, as might be expected. In what other line of work do we find so many examples of feminine heroism as in the telephone field? In those dread visitations of fire, flood and earthquake that all too frequently devastate this or that corner of our country, when every frightened soul is making his way as quickly as he can to places of safety, the operator sticks to her post. It is getting to be trite and commonplace. Sometimes it seems as though the only one to keep her head in the general panic is the telephone girl. She displays a courage and resourcefulness that her sisters in the office and the shop do not even dream of. What better tribute could the company ask to its system of discipline and care?

And on the other hand, the most attractive work in the world today for a girl is telephone operating. She comes to the company unequipped, perhaps, for any work but the most unskilled; yet she is paid while getting her schooling, more than some office positions pay. When she has learned her lesson she is given wholesome work and wholesome recreation,

with discipline that makes a woman of her. And her first lesson as a telephone operator solves the most important problem of life; for she learns self-control.

Is it any wonder that the operators are happy, or that they find good husbands with a facility that is the despair of the telephone companies?

WHY "LONG" DISTANCE?

WHILE talking with a well known telephone engineer the other day we used the familiar term "long distance." And he asked, ruminatively:

"Why *long* distance?"

Why, indeed? To what purpose is the qualifying adjective used? In speaking of travel, of railroad or automobile or pedestrian mileage, we speak of a long distance as distinguished from a short distance. But in the telephone business there is no short distance. Everything that calls for a toll charge is long distance, even if it is only a connection from one local system to its neighbor.

This matter may seem, at first thought, to be merely curious. If words have any weight, however, there may be another phase to the subject. May there not be certain persons who would be moved, by the power of the word *long,* to extend to long distance telephony a greater respect and awe than it is entitled to? Does not the term suggest a certain aloofness that might discourage the simple layman who would otherwise make bold to become acquainted with it? In short, isn't it foolish to use a term that is wholly unnecessary, and that makes the thing seem more of an undertaking than it really is?

The word "distance" alone is just as good as "long distance"—and a whole lot better. It is shorter, simpler and less portentous. It does not suggest so vividly to the unfamiliar user of the toll line that his voice is about to start on a long journey. It merely marks it as something more than a local call.

Let's abolish the word *long* and just call it "distance."

THE CONTEST—AN EXPLANATION.

A FEW months ago Telephone Engineer made an offer of cash prizes for articles calculated to encourage the use of the long-distance telephone. It was realized that certain psychological factors hamper the development of the long-distance call to its possible limits. It is an incontrovertible fact that the average small business man, with at least occasional use for distant communications, exhibits a tendency at such times, to shrink from the telephone, though he probably uses it freely for local calls, and to fall back on the mails or telegraph. It was not argued that this condition is alarming, but merely that it shows a possibility for improvement well worth cultivating.

It was believed that the best way to encourage the use of long-distance by those unaccustomed to it, and consequently not inclined to consider it as a necessity, would be to bring to their notice a literary dissertation on the subject. Of course, such an essay would necessarily be of rather an unusual nature. It must be brief enough and attractive enough to ensure a reading by busy men; clear enough not to demand any considerable application, and, above all, convincing. It was thought that among a possible thirty thousand readers, there would be at least a few who got this viewpoint and were able to carry it out.

We were disappointed. The most careful consideration failed to show that any paper submitted fulfilled the terms of the contest in handling the subject. Many of them were excellent from a literary standpoint; some of them even made interesting reading. But none of them offered anything calculated to persuade the non-user of long distance to turn over a new leaf and begin using it.

We realized from the first that the subject was a hard one, and tried editorially to convince the contestants of that fact. Evidently we did not succeed; for we are still of the opinion that they could have handled the subject effectively with a little more study.

As the matter rests, however, there being no paper that fills the order, the contest is necessarily declared off. And there being no contest, the papers contributed will be returned to their writers. There may be a few which will be deemed available for publication, not as prize articles but in the regular course of editorial make-up. If such is the case, the authors will receive offers for their manuscripts.

THE TELEPHONE IN THE PLAY.

ALONG toward the fag-end of the past theatrical season in New York, says the writer of "On Main Street," in the *Saturday Evening Post,* there was presented by Mr. Charles Frohman a little one-act skit called "A Slice of Life." It was acted by local performers, meaning by that members of the well-known Barrymore family, slightly assisted by Miss Hattie Williams, also of the Frohman school of home talent; and it was from the pen of Mr. J. M. Barrie, a person who has had quite a measure of successes doing things for the stage. It was a most lovely burlesque of the modern drawing-room drama.

As the curtain went up a typical stage housemaid entered, but instead of dusting off the sofa, meanwhile revealing the reason for the play in a loud, monologous tone of voice, she crossed over, picked up a telephone and proceeded to state who and what she was into that instrument. Instantly the audience rocked with laughter, because here was the whole essence of the thing shown in one sudden splash—the conventional and conversational housemaid in her little half-apron and her cap with the ribbon on it, to typify drama as it was, and the one-sided telephone talk to typify drama as it is. Barrie was making fun of his own trade and of its handiest tools. It made a considerable dent on New York—all the critics, or nearly all of them, came right out and admitted that this man Barrie really had the makings of a wag in him.

For years and years and years we were drilled into expecting that the curtain would go up on the neat housemaid. Later on, as the action of the play progressed, she was liable to become musically inclined and burst into songs and roundelays, meanwhile vamping with feet; but at first she was satisfied to come down stage and for a considerable spell talk ostensibly to herself out loud, meanwhile using a feather duster in a perfunctory manner upon the elegant golden oak, upholstered parlor divan or sofa that had been loaned by the Busy Bee Installment House, corner of Main and Market, in exchange for four comps. Even if she hadn't spoken you would have known her for a stage

housemaid by her costume, just as you would have known a stage milkmaid for the same reason—both of them being so utterly unlike the real article in ordinary life. And you got the correct notion regarding what was coming just as soon as she, addressing the footlights, announced pensively that the Manor Hall hadn't seemed the same since the young master was killed riding to hounds.

As I just now remarked, we had her for years and years and years. She got to be as much of a fixture as the red worsted comforters and the earbobs in a Down East play; or a colonial mansion, with the white portico, in the Southern play; or the wounded courier, with fuller's earth dusted on his shoulders and his gauntlets tucked neatly inside his belt, in the military play. She was due, and you expected her and felt disappointed if she didn't show up according to schedule and start things off properly.

All of a sudden, however, here a few years back, some daring playwright made a great discovery. He discovered that the play that was right up to the minute should be opened with a telephone conversation; and that thereafter, at vital moments, when it became necessary to link up the plot, the telephone was still the thing to use instead of falling back on soliloquies or asides. This undoubtedly marked a tremendous advance in the modern drama—the playwrights had only waited about nine years after everybody began employing the telephone in everyday life before they observed its possibilities for producing stage causes and effects; but, once having learned the great lesson, they went to it, as the saying is, practically *en masse*. To the lazy playwright, who wants to bridge over a gap in his play and keep right on, it has proved a precious boon indeed. Once the sluggard was told to go to the ant. Now he knows enough to go to the telephone.

We are used to the innovation. We know just what is coming. The orchestra leader makes a final threatening gesture at his slaves with the fountain pen, or the stick of licorice, or the patent cigar lighter, or whatever the thing is that an orchestra leader waves; and the music, after uttering several despairing glugs, goes down for the last time. The lights flash up on the stage and die down on the house, leaving the audience in that somber gloom where the official pest, who saw the play last week and wants to tell everybody in his section about it, may no longer be seen but only heard—which helps some, but not very much. The curtain rises, revealing a stage set as a drawing room, or as a breakfast room, or as a library. Practical desk telephone at right. Practical fireplace at left. Practical doorway and staircase at back. Practical stageland in practical red-flannel undershirt in wings, manipulating switchboard. Books, flowers, statuary, potted palms, goldfish, daily paper and what-not scattered about. Otherwise the stage is empty—nobody at home apparently. A pause ensues. This gives opportunity for the atmosphere to seep over the footlights and be sopped up by the two-dollar-seaters out front.

Telephone bell rings—ting-a-ling-ling! Nothing stirring—realism, you know—nobody ever answers a telephone the first time it rings, because Central probably has the wrong number anyhow. A pause. Telephone rings again, insistently this time—ting-a-ling-ting-ding-bing—like that! Enter, front back, man-servant—English butler if in a family drawing room; Japanese valet if in a bachelor's apartments. Crosses to right. Business of taking receiver off of hook and applying same to ear. Male servant then speaks into telephone substantially as follows—the English accent or Japanese accent, as the case may be, being omitted by request:

"Hello, sir! Yes, sir—this is Mr. Basil Harcourt's apartments. Is he in? No, sir; but I expect him any moment. Whom shall I say called, sir? Yes, sir—thank you kindly, sir."

And the play is now properly on its way. It is the telephone that started it going and it will be the telephone that keeps it going. At certain points in the old days it would be necessary for some character to step down close to the footlights and indulge in confidential reveries in a tone of voice plainly audible in the top balcony—in theaters noted for faulty acoustics I've known 'em to do their reverieing in a piercing shriek. Now, however, the same character merely goes to the telephone and pours his heart's longings into the hard-rubber nozzle of a transmitter, under pretense of telling them to an imaginary somebody at the other end of the wire, thus posting up the audience, which has paid out its good money and doesn't want to be trifled with; and it's all done without violating the properties or the unities or anything. It is hard to figure out how a modern drama could get through to the end of the last act without the telephone to help out. Search your memory and see if you can think of a single modern play of the last few seasons wherein the telephone did not figure prominently. I've searched mine and I can think of but one—and in that one they fell back on the wireless as a substitute for the telephone, it being a sea play. It took Barrie, though, to realize that the telephone had been a dramatic fixture long enough for him to begin guying it. He may guy it all he pleases, but it will stick. The theater hangs on to its standbys to the last gasp. We think of the theater as constantly changing, constantly offering us new ideas—and maybe it does; but likewise there are a lot of permanent features—regular heroes of '76—that have come down to us through all the generations and still give general satisfaction.

"RUBE" SOLD VIA LONG DISTANCE.

The following from *McClure's* for July, 1912, tells how the negotiations involving "Rube" Marquard, star pitcher of the New York Giants, who recently made a record of nineteen consecutive victories, were conducted over the long distance telephone for the purchase of this great player:

To the private office of an Indianapolis baseball owner there came one day a long-distance telephone call. "This is John T. Brush in New York," a voice said. "I'll give you five thousand dollars for Marquard."

The Indianapolis man laughed. "Nothing doing," he answered.

"I'll give you six thousand," said the owner of the famous New York "Giants."

"You're away down at the bottom," the Indiana voice told him. "Your offer is absurd."

"Seven thousand, then. I'll give you seven thousand in cash!"

But only a mocking laugh traveled back to New York over the copper.

"I'll give you eight thousand." Mr. Brush was in action.

There was a moment's silence. Brush, in a Broadway hotel, heard snatches of a whispered conversation off in Indiana. He had been holding the wire an hour and forty minutes, and the toll of a dollar and a half a minute was still piling up; but he had forgotten it, or was indifferent. Then the Hoosier answer came back: "Too low!"

"Nine thousand!" said Brush promptly.

There was a longer pause this time. Indianapolis was wavering. But presently the owner there got back his nerve. "No, not enough."

"Ten thousand!"

"No; come again."

"I've gone the limit," said Brush; "I'll not pay another dollar!"

"Then good-by," and the Indianapolis receiver clicked on the hook.

A few minutes later the telephone jangled sharply once more in the Indianapolis baseball office. "This is Brush in New York," a voice said. "I'll make my offer eleven thousand—and this is final! I want an answer quick—eleven thousand dollars in cash!"

A silence of ten seconds; then a cough and another silence. "I'll take you," said Indianapolis. "Done!" said Brush. "I'll mail a check in ten minutes."

DEMAND COMPANY SECURE FRANCHISE.

That the Iowa Telephone Company has no right in Des Moines to operate a telephone exchange; that the company must either take out a franchise, grant reasonable concessions to the city, pay a reasonable franchise tax, permit of reasonable regulation, secure the said franchise by a majority vote of the people, or proceed to take up its poles and abandon its local exchanges—is the opinion of both Corporation Attorney H. W. Byers and City Solicitor R. O. Brennan, attorneys for the city of Des Moines in the case of the city against the Iowa Telephone Company.

Accordingly Mr. Brennan urged W. T. Shaver to bring a suit on behalf of the people, and this was accepted by Judge McHenry. Later the Iowa company, through its attorneys, filed an answer, setting up the old claim that it had rights in the city of Des Moines under the state law, and quoting the Chamberlain decision. It is in his demurrer to this answer that Mr. Brennan sets forth the claims of the city that the Iowa has no rights there, other than the rights granted by the state law to run its toll lines through the city, and that it must secure a franchise by a vote of the people, in order to operate exchanges and tear up the streets and alleys for local lines. If Mr. Brennan's demurrer is upheld, the court may also add, in his opinion, that the Iowa has no franchise there, may have a certain specified time to procure one, and that said franchise must be submitted to the people.

The Iowa supreme court has decided that telephone companies may run through cities and towns with toll lines but that they must have franchise from the cities to operate local exchanges. The state law gives city council the power to grant franchises to telephone companies for a period of not over twenty-five years, the same to be ratified by a vote of the people.

A Lot of Loaded Lines

The Finding of Mike Malone.

A knight of the grip was Mike, and a trip had called him away from home.

"Shall I write, wire or 'phone*?" mused Mrs. Malone. For sure 'twas the stork had come!

"Too long takes a letter," she said. "Well, I'd better send fifty words off on a wire."

But the telegraph lad was down town. 'Twas too bad. There was no one that she could hire.

So she grabbed up her 'phone* and said, "Get Malone at one of the hotels in a town. The town's name, did you say? Oh, faith, an' he may be in Denver, put up at the Brown. If not try the Rome—'tis his Omaha home—the Reed House in Council Bluffs, too. Please try your best; 'tis important. I'll rest until your report comes through."

So she lay and mused. "The old 'phone's* been abused. No telegraph message could do all the hunting I ask; 'tis too much of a task and would cost many dollars, too."

Soon her 'phone* bell rang loud and her voice went out proud, sending news of the day to her mate. The 'phone* girl had found him with customers round him, way out in a far western state.

Then Mike and each guest their rapture expressed with a toast to the youngest Malone; but Mike said, "Don't forget that we wouldn't know yet, was it not for the old telephone. Here's a word from a friend: When a message you'd send, tell Central just what you desire, and you'll get it, I know, while you'd not have a show if you waited for postal or wire. A. L. H.

*Colloquialism intended to mean "telephone," now obsolete except under poetic license.

Some men are mighty hard to please. Now there is Nathan Hall, of the Nineteenth ward in St. Louis. Hall is kicking because the Western Union Telegraph Company telephones its messages at terminals instead of delivering them via boy. The trouble started when he received word that a relative was sending him money orders for "250 dollars." Having rushed forth and bought the best diamond clasp $250 would buy, he visited the telegraph office and received 2 money orders for 50 dollars each. He didn't act a bit grateful for the hundred, either, and now he threatens to start an investigation of the system of telephoning telegrams.

Our guess would be, however, that the joke on Hall originated in the telegram, not in the telephone. If the telegraph office couldn't read it right, how could a mere layman hope to?

HOW VERY TRUE.

[From the *Hawthorne Booklet.**]

Nowhere else in the world can be secured a more vivid idea of the tremendous scale upon which American business handles infinitely small details, for in some of the telephone products manufactured here there are hundreds of separate processes carried out and apparatus built rivaling in minute accuracy even the delicate mechanism of a watch gauged so as not to vary the smallest fraction of an inch and yet strong enough to stand even the wear and tear of the myriad wired central office telephone switchboard, throbbing with activity at the center of a great city.

*Thanks to the *W. E. News.*

After all, the farmers are the inventors. A printing telegraph has just been invented by B. Soldatencow, Paris.

OR ELSE THE INDUCTION COIL WAS TWISTED.

[From a Chicago Newspaper.]

When called on the long distance telephone at his home, Mr. Gregory was quite indignant. "I cannot understand why you persist in annoying me about this," he said. "All I care or intend to say about the matter is etaoin etaoin shrdluuuululu 3*9?!***!! . . . . . ? ! ! !;

A Pennsylvania newspaper reporter discovered some pole distribution boxes the other day. He had never seen anything like them before. "The day will soon come," he writes, "when all such contraptions will be put under ground. Poles are bad enough, but when they are used as sites for small buildings it begins to strain a bit." P. H. W.

Taking Care of the Operators

By Mabel Condon

NAPERVILLE! Just a little town in Illinois that is reached in less than an hour's ride on the main line C., B. & Q. railroad, but, nevertheless, a well-known little town to at least five thousand Chicagoans—and they, the girl operators of the Chicago Telephone Company.

For Naperville means to them a haven for the operator who has contracted so much as a hint of that gaunt disease which, if given a chance, mercilessly stalks its prey to the exhaustion state and there awaits with it the approach of death. But the telephone company does not mean that even a chance will be given for the "white plague" to glean so much as one victim from the ranks of its girls. And Naperville is the answer.

A Croquet Court Where Interest in the Game Brings Lustre to the Eyes.

For here is the rest, sunshine and fresh air that is the antidote to the progress of the disease, and it is administered in the first stages of the deceptively high coloring and suspicious cough. Only patients in the incipient stage are cared for at Naperville; any who contract a more dangerous form of the illness are cared for elsewhere, are sent west or south, and the company makes the best possible arrangements for them.

A Musical Program is Given on Impromptu Occasions.

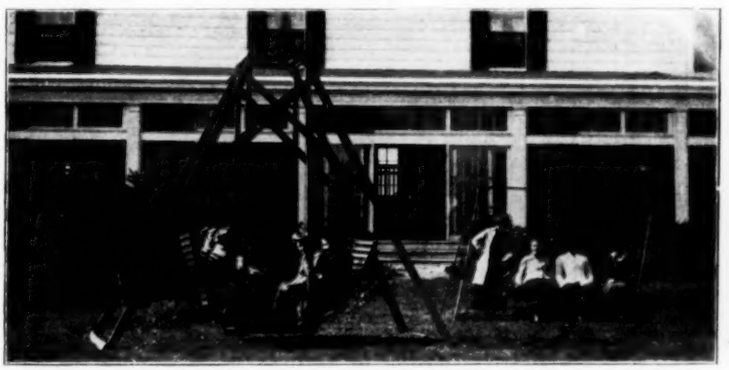
So the patients at Naperville do not at all consider themselves "out of the world," when sojourning in the one-mile-from-town sanitorium that is erected on a high piece of land with grass and trees to each side and back and front of it. It is just the place to get well in, and nature sees to it that the run-down bodies are built anew with the elixir of her treatment. For there is sunshine on every side and there is air pure from the dust of the hurrying cities. It seems impossible, almost, that the air should be so entirely free from soot specks, with Chicago so near, but it is so. The city's dirt is banished.

The health-homes are six or ten-bed shacks, with one side inclosed by but a screen. Here, woolen-wrapped and comfy, in winter and in summer deliciously cool, the girls sleep themselves a good part of the distance toward complete recovery. During the day they sit in steamer-chairs outside the shacks, or, in rainy or snowy weather, rest in chairs on a glass-protected verandah which runs around three sides of the service building, where the general dining rooms and reading rooms are located.

With nothing to do but rest, the girls, as they watch the clouds, the trees, the grass, or listen to the wind, learn to breathe deeply of nature and thus acquire the peace of mind that is so necessary to peace of body.

Just as important as sleeping and resting is eating. Three times a day the patients come to the dining rooms, where substantial meals are served them and, in addition, they lunch twice daily. Good food that nourishes the discouraged system and makes for the building of new tissues is a big factor in the cure of the girls entrusted to nature and Naperville.

For the patients who are able to be allowed exercise, there are pleasant, invigorating walks along pretty



With Nothing to Do But Rest.

roads and through fields and there is a croquet court where the interest in the game brings a lustre to the eyes and a healthful tinge to youthful cheeks.

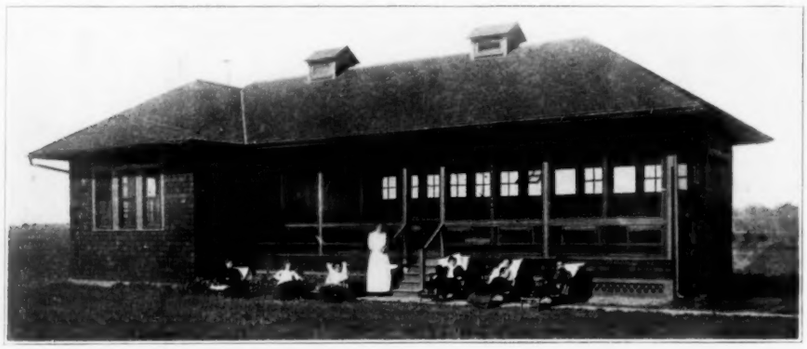
Lest the quiet evenings of talk, letter-writing or reading, become too monotonous, a musical program is given on impromptu occasions, and is taken part in by many of the girls who care to do so. Altogether, the life at Naperville is a pleasant one.

Dr. Theodore B. Sachs is the physician who has charge of the sanitorium. Once a week he deserts Chicago and spends a day at Naperville noting the progress of the patients. He has the assistance of efficient nurses and in their hands he leaves his charges.

There is a hospital department to the fresh-air cure place, but as soon as the patients cared for here are able to be about, they are promoted to the shack division. The three-fold purpose aimed for in their treatment is: the improvement of the general condition, the arrest of the tuberculous process and the restoration of the working capacity.

There is a fee of ten dollars a week for any patient who can afford it, but for those who can't, every privilege and attention is given at the expense of the company. There are shacks for men, too, but the company's biggest work is done among its girls.

A rosy-cheeked, bright-eyed, plump little girl has just returned to Chicago from Naperville. It is hard to believe that she ever had a trace of tuberculosis. But she had, due to overwork at home, where she was an alien, owing to the presence of a foster-mother. Given five months at Naperville, she has become a different person and will resume her work as operator after two months more of rest, which the doctor says is advisable and which the telephone company will make possible.



During the Day, They Sit in Steamer Chairs Outside the Shack and Watch the Clouds, the Trees, the Grass, or Listen to the Wind.

Invigorating Walks Along Pretty Roads.

A Glass Protected Veranda Runs Around Three Sides of the Service Building.

The sanitorium is a co-operative one, other firms in the city having shacks there. While the telephone company as yet has not got its own shack, it has all arrangements made for its immediate construction. Meanwhile, it has bought its interest in the sanitorium and its patients are cared for in whatever shack happens to have room.

There is not a great amount of this illness, however, among telephone girls. The company takes excellent care of its operators during the eight hours the girls spend at the exchanges daily, and in the instances where the disease is contracted, it is found that the fault is in the home or other environment.

To investigate cases where the operators are mentally or physically worried or ill, the company has Miss Cora Kohlsaat as the director of its welfare work. Her duties are many and important, for what is more important than the guarding of health? And that is the object and outcome of Miss Kohlsaat's work.

If a girl at the nickel-board develops the habit of forgetting to collect the nickels deposited, there is a reason. And generally it has to do with some trouble at home, perhaps the shouldering of a debt contracted by illness, death, want or other misfortune, and the physical condition of the girl reflects the trouble. It is the privilege of Miss Kohlsaat to visit the girl at her home and, through the telephone company, administer aid of whatever nature seems necessary. Sometimes it is money, sometimes it is a vacation and rest for the girl, and many times it is expert medical assistance. But whatever the need, there is assistance given and one more telephone operator has realized the guardianship of the company for which she gives up her days and weeks.

Miss Kohlsaat is an experienced social worker and has just returned from a nine months' trip through Europe which she made in the interests of her special line of work. She visited the telephone companies throughout the various countries and not only investigated conditions found in them, but those in factories as well. Her sympathetic knowledge of girls and conditions makes her the confidante of many and her treatment of emergencies is wise and good.

What One Woman Thinks

By Sarah Elizabeth Brown

I LIKE to fuss with figures. Obediah has always maintained that I would get more fancy work done if I did less figuring. Anyway, according to the American Telephone and Telegraph Company, there were 22,000,000,000 telephone calls throughout the world during last year. No estimates on the lost calls. The United States claims 66 per cent of the total. There were 579,000,000 telegrams and the United States claims only 17 per cent. Fourteen billion telephone calls—a little more than six million telegrams. While I think the estimate on the telephone is entirely too low, the figures prove that we have a better telephone system than the foreigners and that the telegraph rates are still too high. In the older countries the telegraph is dependable, though slow, and the rates charged are much less than ours. According to the A. T. & T. Co., the world's investment in telephone property is now over $1,727,000,000, with gross earnings of $329,000,000, or $32.87 per station.

* * *

The Hon. Reed Smoot, United States Senator from Utah, has been interesting himself in the subject of the increased cost of living. His first speech appeared in the *Congressional Record*, May 27, 1910, and the second, August 26, 1912. These speeches are now being franked to farmers' addresses under the caption "Exchange Value of Farm Products, 1911-1896." There are sixteen pages in the pamphlet, which shows the average prices and exchange value of principal farm products for the term mentioned. I have never found tabulated statistics that were more fascinating, and I cannot refrain from giving some examples. During 1896-1911, corn advanced 200 per cent; wheat, 67; oats, 166; rye, 137; hay, 138; potatoes, 282; cattle, 62; hogs, 96; butter, 86; eggs, 90. Products of the south hold strong in comparison. In 1896, ten bushels of corn had an exchange value for 23 pounds of coffee. Today, 46 pounds. Among other things farmers' use, the exchange value today, as compared with 1896, follows:

	1896	1911
Rice, choice domestic, pounds	42	140
Salt, barrels	4	7
Sugar, granulated, pounds	56	123
Tea, Formosa, fine, pounds	2	5
Cotton flannel, pounds (2¾ yds. to lb.)	35	69
Gingham, Amoskeag, yards	48	110
Sheetings, bleached, yards	13	31
Shirtings, bleached, yards	34	85
Petroleum, refined, gallons	23	74
Barb wire, galvanized, pounds	117	350
Nails, wire, eight-penny, pounds	170	433
Brick (bricks)	460	1,066
Cement, barrels	1.2	5
Lime, barrels	4	6
Oak, white, feet	63	127

A satisfactory ratio is held in shoes, clothing, coal, shingles, molasses, etc. Any person who is fond of figuring can compute the exchange values of other farm products, but it is my suggestion that you ask the senator for a copy of his little book. It tells you why the days of the farm loan have passed and explains, also, the tendency of farmers to ride in automobiles while the horses roam in the pastures. From time to time, I have chortled my little lay that the farm was an all right place, and now I know why. Nearly everybody has been kind to the farmer except the packer. I can't see why meat will not go higher. Corn at 200 per cent over 1896 and hogs and cattle only 96 and 62, respectively. Not another hog for the market on our place, thanks to Reed Smoot! But don't you agree with me, my brother, that the farmer has been getting an edge the best of it? And can you wonder that there is a growing tendency on the part of city folk to leave the flats and seek the land? After all, the politics of 1912 will help a lot of people to see

the light. It will start the wheels in some vacuum pates whose owners have been hitting the high spots without license; who are spending more than they earn and spill gasoline without savings accounts. The farmer pays no middleman on his product. He is the increased-cost-of-living baron.

* * *

Mrs. Stephen Jenkins came out to the farm last Wednesday afternoon, when I was out in the back yard stirring off a batch of apple butter. I wasn't expecting company and the only way to entertain Mrs. Jenkins was to have her take a seat on the saw buck while I worked the long-handled ladle in the big copper kettle. It was a beautiful afternoon and the time fairly humped. Mrs. Jenkins has never been known to take a back seat, when it comes to talking, and she was surely wound up on this occasion. You see, Steve has been trying to retire for the past six years and he hasn't been making a success of it. He has just opened a nickel show and Mrs. Steve told me what her old man was up against. I can't begin to tell you about it and I wouldn't make the attempt, if there wasn't a marked contrast in the handling of moving pictures as compared to telephones. Of course, there are some patents. These have been pooled and a certain group are licensed to make films. Then there are the independent makers, who refuse to pay tribute. The licensed folks are called The Trust. It was natural for Mr. Jenkins to seek the independent brands of film. He's a stockholder in our telephone company and he hates a trust like poison. He made the startling discovery that independent films, taken one with another, were not nearly so good as the Trust films. He would have stood for this if there had been any advantage in price. But there wasn't. He rummaged around like a mad man, but he didn't get anywhere, so he settled down to the simple problem of getting the best his money would buy. Mrs. Jenkins had labored so hard in telling me this, I thought I could never put in all on paper. But you see how simple it is. There is no price-cutting. The independents are hanging together, emulating the patent-holders.

* * *

Suppose the first manufacturers of independent telephone apparatus had gone straight to the Bell and begged for a license to make telephones. If their prayer had been denied, instead of going into a frantic contest with each other, they might, more sensibly, have maintained a high price for apparatus all through the years that have seen a gradual revision downwards in the scale. The higher price would have enabled a quicker development of better stuff. The economies that have been forced in manufacture would have enhanced profits. As a consumer of apparatus, this is illogical, coming from me; but I couldn't help thinking, while Mrs. Jenkins kept up her running fire about Steve's trouble, how fortunate we were to have found a different condition among manufacturers of independent telephones. I see that the government is after the big motion picture makers—in which respect they have nothing on the big telephone operator.

* * *

One of the Cleveland dailies printed a story, in effect, that Morgan was about to dispose of his holdings in Ohio telephone properties, giving as the reason that Morgan had become convinced that a consolidation with the Bell was impossible. It took Charley Otis about five minutes to deny the yarn and call it silly. He also declared that a definite announcement concerning the Morgan holdings was apt to be made at any moment. I have been waiting. It is my notion that the Morgan telephone properties represent one of his very best investments. Morgan can get all the money he wants and, as far as I know, he wants all he can get, providing he finds a satisfactory place to lodge it. I am not looking for any hurry-up foolishness in Ohio.

* * *

Did you ever stop to think how long it had taken to interest J. P. Morgan in the independent telephone business? It has always been significant to me that he made his first splash in Ohio. Those Buckeye operators represented the very best of independent telephone organization. They stood together in a common cause and when they were ready to sell, they got a real price for real property. I know of no other state where independents fared so well. Iowa made a very poor second. It goes to show that the men who stand by their guns get the biggest reward. I have frequently urged more enthusiasm for independents, but it has been quiet for a long time, don't you think?

* * *

However, the quiet never bothers country folk. The lull before the storm is full of portent. We know what it means and the suspense doesn't last very long. In the telephone business you can never tell what quiet may mean. We all know part of it. A lot of independents are marking time because they started out with too much lug. Depending on local capital, it took a long time to convince old Money Bags that things would work out all right, if he'd keep his shirt on. As I think of it, there will be an awakening among the independents. Public sentiment cannot be dominated by state commissioners. If the public wants two telephone systems it will have two telephone systems. If it wants one system, it will have one system. The public gets what it wants. It is as notional as a guinea hen, but that doesn't matter. The country is full of money, and money has an awful time finding investment places. Interurban railways have had their inning, coming up and going down while the independent telephone stood still. If the Bell wanted it all, even with its tremendous start, it couldn't get it. The Bell has given too many examples that it doesn't want it all. I may be getting old in my fixed ideas, but I can't help thinking the independents can come back—if they ever get their heads together.

* * *

Right now money is tight and it is dear. If we have anything to regret as a nation, it is to be responsible for a banking system, or a money system, if you like it that way any better, that gouges us all the time. If we have a crop to move; up goes the price of money at the bank and down goes the stock list. The gang that Wall street has made famous have the easy picking. The banker and the piker are the two classes who praise our money system. They know how to work it three ways from the middle. As a nation, we owe $11.35 a head, as government debt. We pay 23 cents a head as interest on the government debt. As a nation, we were reputed to be worth more than $16,000,000,000 in 1860. New York City cleared eleven times that sum last year. We owe more than a billion dollars. Our total money in circulation isn't three

times the amount we owe. The tremendous energy and rapidity of the country's development—the demands upon money—makes us all beggers at the hands of men who dominate it. The post-office address of the "big interests" is New York City. But that is neither here nor there, for money will only be tight while it is being drawn from the mints and marts. When the farmer has it, everybody else will get a share. The farmer is learning to be extravagant, so chirk up. If you need money for your telephone expansion, talk business instead of politics to the erstwhile Hey Rube.

* * *

Next week (estimating that I usually send in my contribution during the third week of each month), will be held in Boston the fifth biennial International Congress of Chambers of Commerce. Being essentially a high-brow organization, it was natural for the American meeting to be held in the capital of New England. There are two classes of delegates: appointees by the leading commercial nations and appointees by the leading business organizations of the world. The subjects discussed are to facilitate the commercial intercourse of nations and to promote cordial relationship between them. I have looked over the program and was not disappointed that the telephone is omitted. All the previous sessions of the congress have been held in Europe, where the telephone is universally cussed, rather than discussed.

* * *

By the way, has Old Grandma Bemis revised her report on the Chicago telephone situation?

Michigan Commission News

The Michigan State Railroad Commission authorized the United Home Telephone company of Ludington to increase its preferred stock from $200,000 to $300,000 and its common stock from $100,000 to $200,000. Permission was also granted to purchase the Citizens Telephone Company of Muskegon. Both companies are independent and are not owned by the Michigan State Company.

The commission authorized the merger of the Washington Home Telephone Company with the Michigan State Company. This is the second big merger allowed by the board recently, the first being the sale of the Home Telephone Company at Detroit. The Washtenaw company was organized in 1903 and operates in Ann Arbor, Dexter, Ypsilanti and vicinity. The consideration named in the articles is $112,500.

The commission says that the evidence disclosed at the hearings show that for the first three years the independent company gave free service to its patrons and for the fourth year it collected five per cent of its regular rates and that only since 1907 has the company demanded full pay according to its established schedule.

The Bell and Home Telephone Company merger, in Detroit, as authorized by the state railroad commission, August 15, was upheld by Judge Collingwood, of the Ingham county circuit court, in an opinion handed down recently, and the bill of complaint filed by the Grass Lake Telephone Company, which sought to have the merger held up, was dismissed.

The decision has an important bearing on the question of telephone mergers in Michigan. It upholds that section of the Giles law giving the railroad commission authority to allow mergers. Judge Collingwood says that if the legislature deemed it more efficient regulation to allow competing companies to merge under the authority of a public commission which authorized to regulate the service and the cost to the public and to prevent unreasonable terms and conditions from being imposed upon the public, such legislation is strictly within the province of that body and not to be interfered with by the courts.

The Deerfield Farmers' Telephone Company and the Blissfield Telephone Company of Lansing, are objecting to the issuing of a certificate of necessity and public convenience to the Riga Farmers' Telephone Company. The latter company now has an application before the state railroad commission. The two former companies and the Michigan Telephone Company all having exchanges in the village of Blissfield, although it has less than 1,000 people.

The Riga company recently organized and has filed articles of incorporation with the secretary of state. It now seeks the certificate from the commission which is required by the Giles law. It has 60 subscribers.

The Blissfield and Deerfield companies are opposing the issuance of the certificate on the ground that the move is but a scheme on the part of the Bell people to eliminate them from competition. They say the Bell people attempted to buy them out and failing in that, seek to form a "dummy" company which will cut the rates.

The commission rendered an important decision in the matter of the application of the Vermontville Farmers' Independent Telephone Company for a certificate of public convenience and necessity, in which the commission denies the company authority to construct a new telephone system in Eaton county.

This decision is the first of its kind to be rendered by the railroad commission under the Giles law and the decision will, in a great measure, decide the future of other independent companies who are seeking to build new lines. The Vermontville company filed its articles of incorporation January 31, 1912, as the result of an increase in rates from $12 to $15, by the Citizens' Telephone Company of Vermontville.

California Commission News

The Coast Counties Gas & Electric Company has filed with the California Railroad Commission its answer to the complaint recently brought by the Pacific Telephone & Telegraph Company. The telephone company complained that the power company was constructing a high-tension power line in Santa Clara County near Gilroy which would seriously interfere with the telephone service. It requested the commission to compel the power company to move its line to a distance of 1850 feet from the telephone wires. In its answer the Coast Counties Company states that its line has been in operation in the vicinity of Gilroy since July 1, 1912, and that the telephone company has been able to continue the operation of its wires undisturbed. The power company states also that the transmission of electricity at a high potential is necessary in the state of California, and that if power companies were required to give way to telephone lines an extensive district throughout the state would remain unserved with electric power.

Impedance of Telephone Receivers

By A. E. Kennelly and G. W. Pierce*

THE writers have recently made a series of measurements of the resistance, inductance, reactance and impedance of various telephone receivers, at different frequencies up to 2,400 cycles per second, some of the results of which are very interesting and apparently new.

The connections used are shown in Fig 1. The telephone receiver T under test was placed in one arm of a Rayleigh bridge $A\ B\ C\ D$. The arms $A\ D$ and $D\ C$ were non-inductive resistances of 5 ohms each. The arm $B\ C$ contained an adjustable non-inductive resistance R and an adjustable Ayrton-Perry inductance variometer L. In order to obtain a balance, with silence in the head telephones H, it was necessary to adjust both the resistance R and the inductance L to values which represented the resistance and inductance of the telephone T at the frequency of the test.

The source of alternating currents was a Vreeland oscillator V with its primary circuit supplied from 118-volt direct-current mains. The secondary voltage was maintained constant throughout each series of tests with the aid of the electrostatic voltmeter E. The frequency supplied by the oscillator was ordinarily varied by varying the condenser c. The frequency could be adjusted to any desired value between the limits of 430 and 2,400 cycles per second. The frequency, once adjusted, remained substantially constant.

A non-inductive resistance R'', between the oscillator and the Rayleigh bridge, enabled the current supplied to the bridge to be controlled and computed. Calling e_t the voltage at telephone terminals and e_s the voltage at Vreeland secondary terminals, the conditions for balance, very nearly gave:

$$e_t = e_s \frac{5}{R'' + 10} \quad \text{Volts} \quad (1)$$

and this voltage e_t remained constant throughout each series of tests. In different series of tests, e_t varied from 0.3 volt to 1 volt.

The frequency of the alternating current supplied to

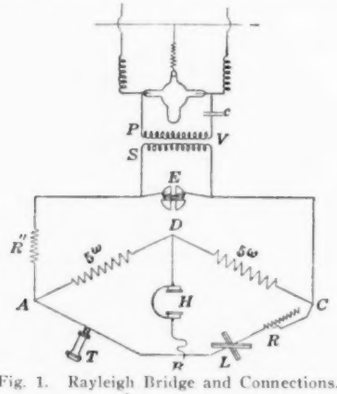


Fig. 1. Rayleigh Bridge and Connections.

the bridge was measured by tonometer; that is, by comparing the pitch of the sound emitted by the telephone T with that of the nearest of a series of 75 tuning forks ranging in frequency from 256 to 552 double vibrations per second, by successive steps of four vibrations per second. Having found two adjacent forks of the series between the pitches of which lay the pitch of the sound in the telephone T, the relative nearness of the two could be estimated by listening to the acoustic beats. These acoustic measurements of the frequency were checked by electric measurements of the inductance and capacity in the Vreeland oscillator circuit, and also, in one or two instances, by stroboscopic measurements of the flicker frequency of illumination from the Vreeland tube.

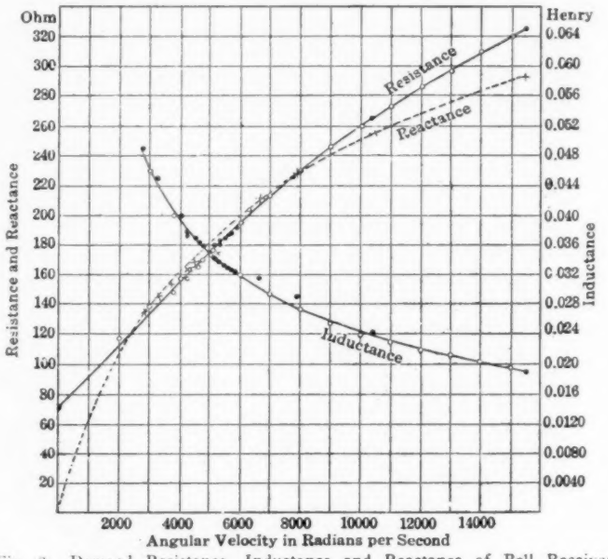


Fig. 2. Damped Resistance, Inductance and Reactance of Bell Receiver at Different Angular Velocities.

MEASUREMENTS WITH THE DIAPHRAGM DAMPED AND FREE.

In making a series of Rayleigh bridge measurements of the resistance and inductance of a telephone at successively increasing frequencies it was soon found that the measured values were different when the diaphragm of the telephone was damped by pressure from the finger, so as to be incapable of vibrating, and when it was released or free to vibrate. The "damped" resistance and inductance differed indeed but little from the "free" resistance and inductance, when the frequency impressed on the Rayleigh bridge was either low or high in the range of experiment. At and near the natural fundamental frequency of the diaphragm, however, the damped resistance and inductance differed markedly from the corresponding free values, and evidently for the reason that when the impressed frequency was in consonance with the natural vibration frequency of the diaphragm the latter was thrown into powerful resonant vibration, giving out a powerful sound. This large motion of the diaphragm, in the magnetic field of the telephone, induced an alternating emf of like frequency in the telephone coils, thus altering their apparent resistance and inductance. The difference between the free and damped value of a resistance, inductance, reactance or impedance, at any given

*Paper read before the British Association at Dundee, September 5, 1912.

frequency, may be called the "motional" value. The motional impedance always reached its maximum at consonance betwen the impressed and natural vibration frequency. It varied in magnitude from 185 ohms in the case of a certain monopolar experimental receiver down to values too small to recognize with certainty in cases of receivers dynamo-electrically very weak.

PARTICULARS OF RECEIVERS TESTED.

Four receivers were particularly investigated as follows:

(1) A Western Electric bipolar Bell telephone, type 122.

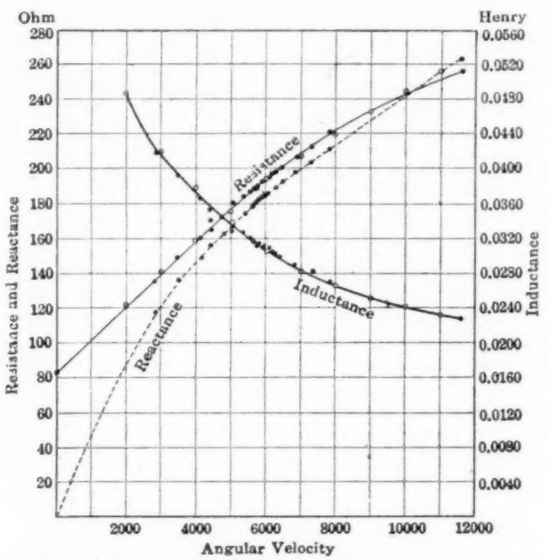


Fig. 3. Damped Resistance, Inductance and Reactance of Watchcase Receiver at Different Angular Velocities.

(2) A Western Electric bipolar watchcase receiver, here designated "watchcase."

(3) An experimental specially constructed monopolar receiver, with a laminated pole.

(4) An experimental specially constructed bipolar receiver provided with exploring coils and with laminated magnetic circuit.

The accompanying table contains some of the mechanical particulars of these instruments.

MECHANICAL CONSTANTS OF RECEIVERS.

	No. 1. Bell Bipolar.	No. 2. Watchcase.	No. 3. Experimental Monopolar.	No. 4. Experimental Bipolar.
Direct-current resistance of coils, ohms at 20 deg. C.	71.0	81.4	89.7	25
Area of each pole in cm. × cm.	1.4×0.225	1.61×0.16	0.53×0.53	1.17×0.38
Distance separating poles, cm.	0.85	0.80	....	0.73
Extrenal diameter of diaphragm, cm.	5.40	5.48	7.22	7.22
Diameter of clamping circle, cm.	4.94	4.84	4.45	4.45
Thickness of diaphragm, cm.	0.024	0.030	0.022	0.022
Weight of diaphragm, gm.	4.0	5.03	5.3	5.3

OBSERVED EFFECTS OF INCREASE IN FREQUENCY ON DAMPED RESISTANCE.

It is well known that the apparent resistance of a telephone receiver increases with increase of frequency owing to the increasing expenditure of energy, in heat, through eddy currents and hysteretic losses. Figs 2 and 3 indicate the observed changes in resistance, inductance and reactance as ordinates for the Bell and watchcase receivers respectively, with 0.3 volt at terminals, as the frequency is varied. The abscissas are marked off to a scale of angular velocity ω, in radians per second, instead of frequency in cycles per second. The frequency can, of course, be found for any given angular velocity by dividing by 2π.

Thus, referring to Fig. 2 and the curve of resistance, the black dots indicate observed values. The damped resistance was thus 71 ohms at $\omega = 0$, and increased from 146.3 ohms at $\omega = 2760$ ($f = 440 \sim$) to 325 ohms at $\omega = 15{,}500$ ($f = 2464 \sim$).

The observed values of resistance correspond satisfactorily to the quadratic relation:

$$R = 71 + 0.0234\,\omega - 0.456 \times 10^{-6}\,\omega^2 \quad \text{ohms (2)}$$

as is shown by the small circles on the resistance curve which indicate points computed from formula (2). In Fig. 3 the curve through the black dots of observations for the watchcase receiver corresponds satisfactorily to the similar quadratic relation:

$$R = 81.4 + 0.0214\,\omega - 0.505 \times 10^{-6}\,\omega^2 \quad \text{ohms (3)}$$

OBSERVED RELATIONS BETWEEN DAMPED RESISTANCE AND DAMPED INDUCTANCE AT DIFFERENT FREQUENCIES.

Figs. 2 and 3 indicate that the measured damped inductance falls with increasing frequency as the resistance increases. It is interesting to observe that in each case the product of the damped resistance and damped inductance remains approximately constant over the entire range of frequencies used, or the product is independent of the frequency over this range. Thus for the Bell receiver of Fig. 2, at 0.3 volt,

$$L = \frac{6.25}{R} \quad \text{henrys (4)}$$

and for the watchcase instrument of Fig. 3, at 0.3 volt,

$$L = \frac{5.88}{R} \quad \text{henrys (5)}$$

The black dots on the inductance curves correspond, as

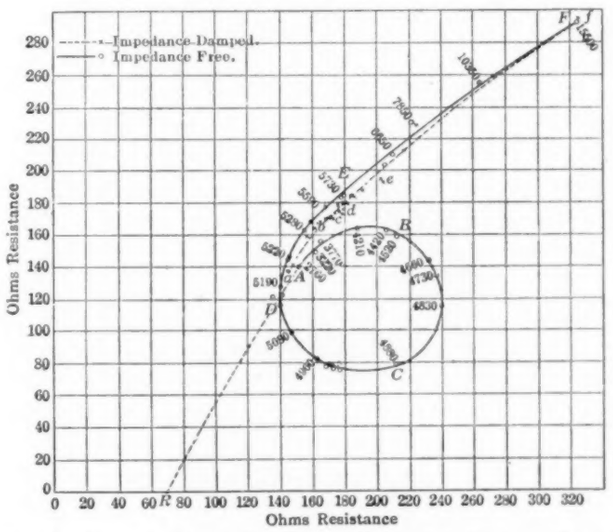


Fig. 4. Vector Impedance Diagram of Bipolar Bell Receiver, Damped and Free, at Different Frequencies.

before, to observations, and the small circles to values computed from (4) to (5).

OBSERVED RELATIONS BETWEEN DAMPED RESISTANCE AND DAMPED REACTANCE.

Multiplying the observed damped inductance L' by the angular velocity ω of the observation, we obtain the damped reactance $L'\,\omega$ plotted in Figs. 2 and 3 through the small crosses. It will be observed that, although the

observed damped inductance diminishes with the frequency, the damped reactance increases with the frequency in essentially the same manner as the resistance, except in the neighborhood of zero frequency. In fact, with these receivers, the damped reactance is approximately equal to the damped resistance over a considerable range of frequency. This means that the damped impedance is approximately $\sqrt{2}\,R$ 45° ohms over this range.

EFFECTS OF MOTION OF THE DIAPHRAGM UPON THE RESISTANCE AND REACTANCE.

In order to analyze the effects of motion of the diaphragm on the electrical properties of a receiver it is important to measure, at any given frequency and at constant terminal voltage, the resistance and inductance of the receiver, both damped and free.

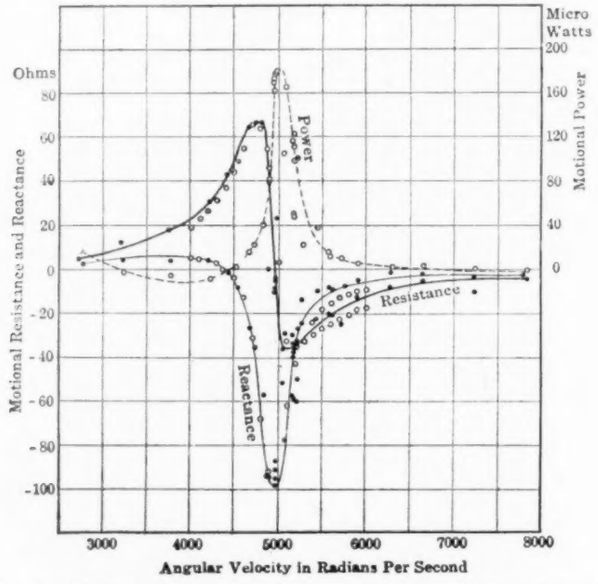


Fig. 5. Motional Values of Resistance, Reactance and Power for Bell Receiver with 0.3 Volts at Terminals and with Different Angular Velocities.

Fig. 4 shows the locus of observed free and damped impedance in the case of the Bell bipolar receiver with 0.3 volt at terminals. Commencing at the angular velocity of $\omega = 2760$ radians per second ($f = 440 \sim$), the free impedance is $O\,A = 152$ ohms resistance, measured along the axis of abscissas, plus j 138 ohms reactance, measured parallel to the axis of ordinates. At the same frequency the damped impedance was $O\,a = 146.3 + j\ 135.1$ ohms. Below 440 cycles per second the impedance was not measured either free or damped; but the impedance locus may be assumed to follow the line of points $R\,A$, because at $\omega = 0$; or, with direct currents, the impedance was $O\,R = 71 + j\ 0$ ohms.

As the angular frequency advances beyond 2760 radian per second the free impedance pursues the looped path $A\,B\,C\,D\,E\,F$, while the damped impedance pursues the smooth curve $a\,b\,c\,d\,e\,f$. Thus, at the angular frequency of 4880 radians per second, the free impedance is $O\,C = 212 + j\,78.1$ ohms, while the damped impedance is $O\,C = 173 + j\,171.4$ ohms. It will be observed, therefore, that there must be two widely different angular velocities (about 2000 and 5150 radians per second) at which the impedance is identical and in the neighborhood of $O\,D$, although with the diaphragm damped the impedance would have changed from about $O\,D$ to $o\,d$, two values which would differ from each other by about 80 ohms.

Figs. 5 and 6 give the motional values of resistance, reactance and power for the Bell bipolar receiver with 0.3 and 0.42 volt at terminals respectively. If at any impressed angular frequency ω we denote the current strength, resistance and inductance by I', R' and L', with diaphragm free, also by I, R and L when damped, then the motional resistance is $(R' - R)$ ohms, the motional inductance $(L' - L)$ henries, the motional reactance $(L'\omega - L\omega)$ ohms, the motional impedance $(R' - R) + j\,(L' - L)\,\omega$ ohms, and the motional power $(I'^2R' - I^2R)$ watts. The values of I' and I were not directly observed but were computed from the constant terminal voltage and the observed impedance of the receiver. It will be observed that the motional resistance in Fig. 5 changes suddenly from $+68$ ohms, at 4830 radians per second, to -36.5 ohms at 5050 radians per second. The motional reactance develops a sharp negative maximum near 5000 radians per second. The motional power is negative near 4000 radians per second, but rises to a sharp maximum of 180 microwatts near 5000 radians per second. Not all of this motional power is necessarily available for producing energy of vibrational motion in the diaphragm, but the power expended in moving the diaphragm and in producing sound is associated with this

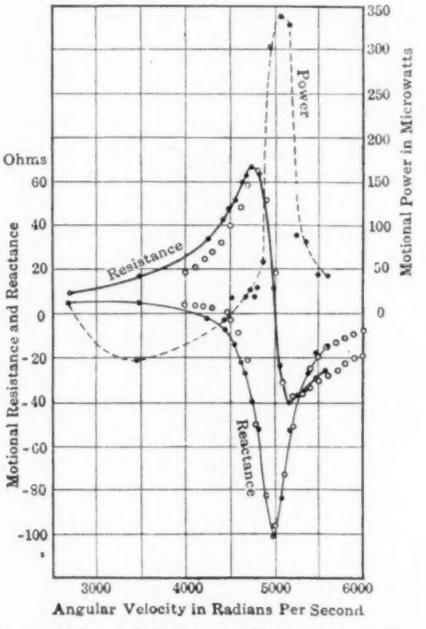


Fig. 6. Motional Values of Resistance, Reactance and Power for Bell Receiver Rv with 0.42 Volt at Terminals and with Different Angular Velocities.

motional power. It would seem possible to measure the amount of power expended by the telephone diaphragm in sound through the use of an air pump to exhaust the air from a chamber containing the telephone, keeping all other conditions the same. The increase in motional power, at constant current strength, after admitting air into the chamber, should determine the power expended in sound. In the measurements here reported the electrical measurements were often distinctly, and sometimes markedly, affected by the absorption of reflection of sound waves from neighboring objects when the maximum

sound and motional power were being developed. If an assistant walked across the room in front of the sounding telephone under test and at a distance of a meter or more from its face, the Rayleigh bridge balance was apt to be seriously upset. In the case represented by Fig. 6, of the Bell receiver with 0.42 volt at terminals, the motional power at resonance is 338 microwatts, an increase of 68 per cent over the damped power at the same frequency. That is, if the finger is removed from the diaphragm at this frequency, this telephone emits a loud sound and the power expended in the telephone jumps up 68 per cent.

CIRCULAR GRAPHS OF MOTIONAL IMPEDANCE.

If in Fig. 4, instead of plotting motional resistance and motional inductances as ordinates against angular frequencies as abscissas, we plot, from a selected point as origin, the vector motional impedance $a\,A$, $b\,B$, $c\,C$, etc., as in Fig. 7, we find that these vectors lie upon a circle, which may be called the circular graph of motional impedance. It will be seen that in Fig. 7 the motional impedance of the Bell telephone there represented is a pure resistance of 36 ohms near the angular frequency of 4300 radians per second, whereas it is a pure reactance of 95 ohms in the neighborhood of 4950 radians per second. At other frequencies it is a combination of resistance and reactance. The maximum motional impedance is the diameter of the circle and is 103 ohms, at an angle 70.5 deg. below the axis of resistance $O\,R$, and at the frequency 4885 radians per second, which is the resonant frequency of the receiver, or the fundamental frequency of its diaphragm. The small circles represent the observations, and the scale of numbers on the inside rim of the circle indicates computed values. It will be seen that the motional impedance on the graph commences at o for very low frequencies, reaches its maximum diametral value for the resonant frequency, and then diminishes

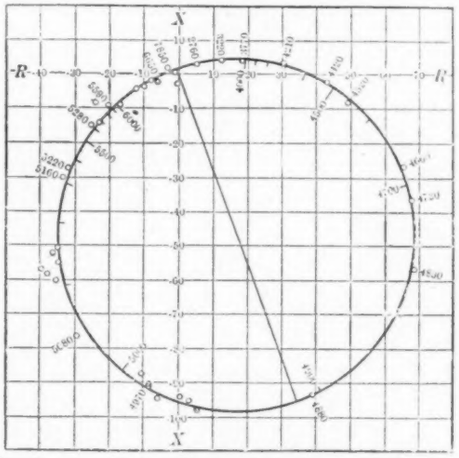


Fig. 7. Circular Graph for Bipolar Bell Receiver with 0.3 Volt at Terminals.

again toward zero as the frequency is further increased.

In Fig. 8 the corresponding circular graph of motional impedance is presented for the same receiver as in Fig. 7, but with the terminal voltage raised to 0.42 volt. It does not differ materially from the graph of Fig. 7.

The circular graph for the watchcase receiver is given in Fig. 9. Here the diameter is depressed by an angle of 93 deg. below the axis of resistance.

In Fig. 10 are collected five circle graphs, all drawn to the same scale. The largest circle happens to belong to the experimental monopolar receiver and the smallest circle to the experimental bipolar receiver, both employing the same diaphragm. It appears that the frequency of resonance is a property of the diaphragm only; as is also the spacing of the frequencies around the circle. On the other hand, the diameter of the circle, both as to magnitude and as to depression angle, depends upon the electromagnetic circuit of the receiver. The more powerful the inducing system the larger the diameter. The depression angle appears from the theory to be twice the angle

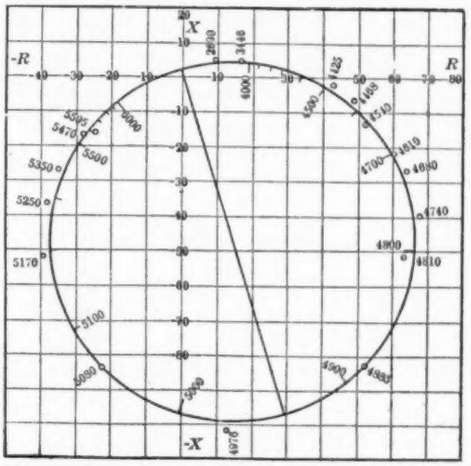


Fig. 8. Circular Graph for Bell Receiver with 0.42 Volt at Terminals. Diameter 103.5 Ohms. Depression Angle $2B = 73°$ $Wo = 4940$ Radians per second.

of lag of magnetic flux behind electric current in the coils. This was found to be substantially true in the case of the experimental bipolar receiver, which was constructed with special exploring coils for investigating this point.

The circular graph of a receiver thus enables the natural frequency of the receiver diaphragm to be readily determined, and two distinct electrical methods are therefore available for the determination of this natural frequency. Moreover, the theory of the subject indicates that the damping coefficient Δ of the diaphragm, or the log decrement per second of its free vibration, can also be obtained from the circular graph. In particular, if we find the frequencies ω_1 and ω_2, which correspond to the opposite ends of a diameter, perpendicular to the principle diameter of the graph, then Δ will be half the difference between ω_1 and ω_2. Thus, in Fig. 7, the angular velocities ω_1 and ω_2, quadrantal to the principal diameter, are approximately 5100 and 4700 radians per second respectively, so that $\Delta = \frac{5100 - 4700}{2} = 200$ per second.

This means that the diaphragm, if set in free vibration, would have its amplitude fall to $1/\epsilon$, or to 0.3678, in a time equal to $1/\Delta$ seconds, or the two-hundredth part of one second. The further apart the quadrantal frequencies lie numerically, the larger is Δ and the greater the natural damping of the diaphragms vibrations, or the sooner the amplitude of vibration will fall to $1/\epsilon$ th.

THEORY OF THE CIRCULAR GRAPH OF MOTIONAL IMPEDANCE.

As a first approximation to the theory, we shall assume that, so far as concerns the fundamental frequency of the diaphragm, the elastic restoring force of the diaphragm is concentrated at the center and is proportional to the displacement; that the actually distributed mass of the diaphragm may be replaced by an equivalent

mass concentrated at the center, and that the motion is opposed by a frictional force proportional to the velocity and also concentrated at the center. Then, if the diaphragm is solicited by a sinusoidal force of maximum cyclic value F (Fig. 11),

$$sx + rx' + mx'' = f = Fe^{j\omega t} \quad \text{dynes} \quad \angle \ (6)$$

where

x = the displacement of the effective mass of the diaphragm from its position of rest (cm).

x' = the displacement velocity (cm/sec).

x'' = the displacement acceleration (cm/sec^2).

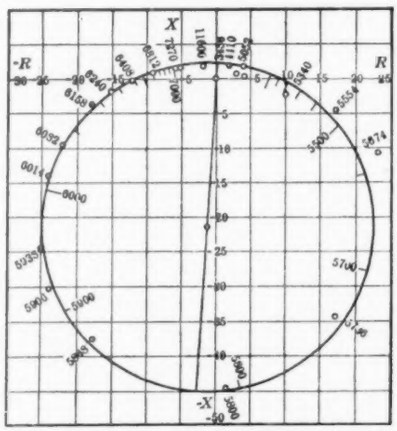


Fig. 9. Circular Graph for Watchcase Receiver. Diameter 47 Ohms. 0.3 Volt at Terminals.
Depression Angle B = 93°. W_0 = 5820 Radians per Second. Δ = 150.

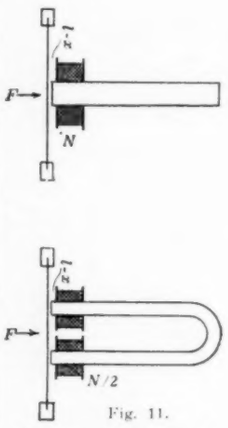


Fig. 11. Sections of Monopolar and Bipolar Telephones.

s = the elastic force per unit displacement (dynes/cm).

r = the resisting force per unit of velocity (dynes per cm per second).

$f = Fe^{j\omega t}$, the impressed moving force measured in the direction of x toward the poles (dynes).

$\omega = 2\pi n$, the angular velocity of the impressed force (radians per second).

n = the frequency of the impressed sinusoidal force (cycles per second).

$j = \sqrt{-1}$.

The solution of equation (6) for velocity of displacement is well known and may be written in the form

$$x' = \frac{f}{r + j\left(m\omega - \frac{s}{\omega}\right)} = \frac{f}{z} = \frac{Fe^{j\omega t}}{z} \quad \text{cm/sec} \quad \angle \ (7)$$

where

$$z = r + j\left(m\omega - \frac{s}{\omega}\right) \quad \text{dyne sec/cm} \quad \angle \ (8)$$

This solution corresponds precisely to the well-known case of a sinusoidal emf impressed upon a simple series circuit of resistance, inductance and capacity. The mechanical displacement x corresponds to electric quantity, the displacement velocity x' to electric current, the velocity opposing resistance r to the current opposing resistance, the mass m to the inductance, and the mechanical elastance s to the electric elastance, or reciprocal of capacity. The quantity $m\omega$ may therefore be called the mechanical inertia reactance, the quantity s/ω the mechanical elastic reactance, and z the mechanical vector impedance. Consequently, just as in the electric circuit considered, it can be shown that the graph of the electric current is a circle, as the frequency varies from 0 to infinity, so the displacement velocity graph is also a circle. The diameter of the circle will coincide with the axis of reals, and will be equal to F/r cm/sec for the frequency of resonance; *i. e.*, that frequency at which the inertia reactance $m\omega$ is equal and opposite to the elastic reactance s/ω or when the total reactance vanishes. The phase of the velocity will then concur with that of the impressed force. For sub-resonant frequencies the phase of the velocity will lead, and for super-resonant frequencies the phase of the velocity will follow that of the impressed force.

The mechanical force f, above considered, is produced by the magnetic flux across the air-gap or gaps of the receiver. If Φ is the mean flux through the active part of the magnetic circuit, we have in a bipolar receiver:

$$\Phi = \frac{F}{R} = \frac{F_0 + 4\pi Ni}{R_0 + \frac{2(l-x)}{S}} = BS \quad \text{maxwells} \quad (9)$$

and in a monopolar receiver:

$$\Phi = \frac{F}{R} = \frac{F_0 + 4\pi Ni}{R_0 + \frac{l-x}{S}} \quad \text{maxwells} \quad (10)$$

where

F = the total mmf due to the permanent magnet and to the current in the coils (gilberts).

F_0 = the mmf due to the permanent magnet alone (gilberts).

R = the total reluctance of the magnetic circuit (oersteds).

R_0 = the reluctance of the circuit exclusive of the air gaps (oersteds).

N = the total number of turns in the receiver coil or coils.

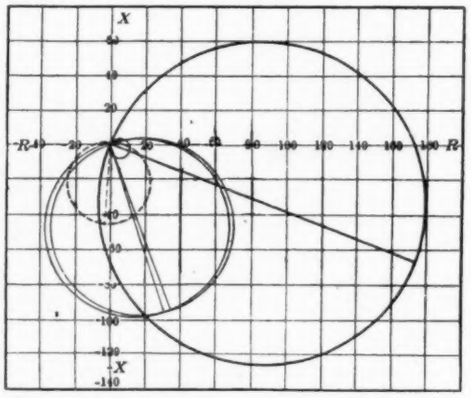


Fig. 10. Collection of Circular Graphs to Same Origin and Scale.
Large Heavy Circle, Monopolar. Pair of Adjacent Light Circles, Bell Bipolar with 0.3 and 0.42 Terminal Volt Respectively. Broken Line, Watchcase Receiver. Small Black Circle, Experimental Bipolar Receiver.

$i = Ie^{j\omega t}$, the instantaneous current in the coils (absamperes).

l = normal air-gap between poles and diaphragm (cm).

B = mean flux density in the air-gap (gausses).

S = area of one gap (cm^2).

Then

$$f = 2S\frac{B^2}{8\pi} = \frac{\Phi^2}{4\pi S} \quad \text{for a bipolar receiver} \quad \text{dynes} \quad (11)$$

and

$$= S\frac{B^2}{8\pi} = \frac{\Phi^2}{8\pi S} \text{ for a monopolar receiver} \quad \text{dynes} \quad (12)$$

If we denote by f_1 the relatively small part of the total force which is due to the current i, we may write:

$$f_1 = \frac{df}{di} i \quad \text{dynes} \angle \quad (13)$$

which, by substituting from (11) and (9), becomes:

$$f_1 = \frac{2\Phi}{4\pi S} \cdot \frac{d\Phi}{di} \cdot i$$

$$= \frac{2N\Phi}{RS} i = \frac{2NB_a}{R} i \text{ for a bipolar receiver dynes} \angle \quad (14)$$

and

$$f_1 = \frac{NB_a}{R} i \quad \text{for a monopolar receiver} \quad \text{dynes} \angle \quad (15)$$

In order to avoid maintaining parallel discussions for bipolar and monopolar receivers, it will suffice to write:

$$A = \frac{2NB_a}{R} \text{ for a bipolar receiver dynes/absamperes} \quad (16)$$

and

$$A = \frac{NB_a}{R} \text{ for a monopolar receiver dynes/absamperes} \quad (17)$$

In either case then $f_1 = A\,i$ dynes $\angle$ (18)

on the assumption that the pull on the diaphragm is in phase with the flux, and that the flux is in phase with i. But owing to the effects of hysteresis, as modified by eddy currents, the flux and the pull will lag behind i by a certain angle β_1; so that (18) becomes

$$f_1 = A\,i \angle\beta_1 \quad \text{dynes} \angle \quad (19)$$

Consequently by (7) $x' = \dfrac{A\,i \angle\beta_1}{z}$ cm/sec $\angle$ (20)

The emf induced in the coils by the motion of the diaphragm will be, in the absence of hysteresis,

$$e_x = N\frac{d\Phi}{dt} = N\frac{d\Phi}{dx}x' \text{ abvolts} \angle \quad (21)$$

and by differentiating (9) or (10), this becomes

$$e_x = \frac{2NB_a x'}{R} = A\,x' \quad \text{abvolts} \quad (22)$$

and substituting from (20)

$$e_x = \frac{A^2 i \angle\beta_1}{z} \quad \text{abvolts} \quad (23)$$

But there will also be a hysteretic lag of flux with respect to change of air-gap length, and this will cause the induced emf to lag by a certain angle β_2. Consequently, (23) becomes:

$$e_x = \frac{A^2 i \angle\beta_1 + \beta_2}{z} \quad \text{abvolts} \angle \quad (24)$$

If L and R'' are the inductance and resistance of the receiver when damped, in abhenries and absohms respectively, the damped impedance of the receiver will be:

$$Z = R'' + j\,L\,\omega \quad \text{absohms} \angle \quad (25)$$

If e is the instantaneous value of the impressed sinusoidal emf of the type $Ee^{j\omega t}$ abvolts, we have,

$$e = i\,Z \quad \text{abvolts} \angle \quad (26)$$

But, owing to the influence of the emf of motion, the last equation becomes, when the diaphragm is free:

$$e = e_x + i\,Z \quad \text{abvolts} \angle \quad (27)$$

That is, by (23),

$$e = i\left\{Z + \frac{A^2}{z}\angle\beta_1 + \beta_2\right\} = i\,Z' \quad \text{abvolts} \angle \quad (28)$$

where Z' is the free impedance of the receiver, in absohms.

This means that the impedance of the receiver has become increased, through the motion of the diaphragm, by a motional impedance:

$$Z' - Z = -\frac{A^2}{z}\angle\beta_1 + \beta_2 \quad \text{absohms} \angle \quad (29)$$

This motional impedance, being the reciprocal of z, a straight line locus, when ω is variable, is a circle for variable ω, with a diameter A^2/r absohms, depressed below the axis of reals by an angle $\angle\beta_1 + \beta_2$. It seems reasonable that whether the flux lags behind a cyclic magnetizing current or behind a cyclic air-gap reluctance, the angle of lag should be the same; or that $\beta_2 = \beta_1 = \beta$ say. This equality was substantially borne out in the experimental case. Consequently, we may write (29)

$$Z' - Z = -\frac{A^2}{z}\angle 2\beta \quad \text{absohms} \quad (30)$$

Therefore, if we vary ω from o to ∞, keeping the impressed emf and all other quantities constant, the motional impedance has a circular graph through the origin, with its principal diameter of length A^2/r, depressed 2β below the axis of reals.

In the particular case when the angular velocity ω_0

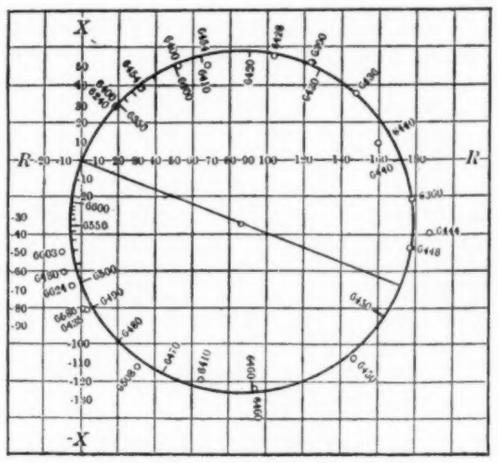


Fig. 12. Circular Graph of Experimental Receiver.

is such that the inertia reactance $m\,\omega$ is equal to the elastic reactance s/ω_0—that is, when

$$\omega_0 = \sqrt{s/m} \quad \text{rad/sec} \quad (31)$$

the mechanical impedance z becomes by (8) equal to the mechanical resistance r, and (30) becomes, for the resonant condition: $Z' - Z = -\dfrac{A^2}{r}\angle 2\beta$ absohms (32)

the principal diameter of the circular graph.

Again, let $\triangle$ be the logarithmic decrement per second of the diaphragm, if vibrating in the absence of impressed forces; then, by the theory of elasticity:

$$\Delta = \frac{r}{2m} \quad \text{numeric/sec} \quad (33)$$

and if a is the angle of the mechanical impedance z in (8),

$$\tan a = \frac{m\omega - \frac{s}{\omega}}{r} \quad \text{numeric} \quad (34)$$

From (33) and (34)

$$\omega \tan a = \frac{\omega^2 - \omega_0^2}{2\Delta} \quad \text{numeric/sec} \quad (35)$$

An equation from which the angular position in the circular graph can be found for each value of ω, knowing ω_0 and Δ; or, having found ω_0 from the graph and at one other frequency ω, the point corresponding thereto on the graph, with its vector making an angle a with the diameter, we may use (35) to find Δ. In particular, if we choose a quadrantal point on the graph at which ω is ω_1 say, so that $a = 45$ deg. and $\tan a = 1$, we obtain:

$$\Delta = \frac{\omega_1^2 - \omega_0^2}{2\omega_1} \quad \text{numeric/sec} \quad (36)$$

Or, if we select the two quadrantal points which lie respectively 45 deg. below and above the principal diameter, and for which $\tan a$ is respectively $+1$ and -1, we obtain from (35)

$$\Delta = \frac{\omega_1 - \omega_2}{2} \quad \text{numeric/sec} \quad (37)$$

The measurements described in this paper thus enable ω_0 and Δ to be determined for a telephone receiver, but do not permit of determining the fundamental constants r, m and s. Nevertheless, it would seem that if, after taking such a series of measurements on a receiver, a small load of known mass were secured to the center of the diaphragm and the series repeated, the two series should enable these fundamental constants to be evaluated between them.

SUMMARY OF RESULTS AND CONCLUSIONS.

(1) The resistance and inductance of several telephone receivers were measured over a wide range of frequencies, with their diaphragms both free and damped.

(2) In two typical forms of receiver the damped resistance was found to be a quadratic function of the frequency.

(3) Although the damped resistance and the damped inductance both vary with the frequency, their product was found to be a constant, independent of the frequency, over a considerable portion of the range of audible frequencies.

(4) The free resistance and reactance of a receiver go through marked changes with changes of impressed frequency in the neighborhood of the natural fundamental frequency of its diaphragm.

(5) The motional resistance and motional reactance —that is, the excess of free over damped resistance or reactance—conform accurately to certain simple laws, thus:

I. The motional reactances plotted as ordinates against the motional resistances as abscissas as the frequency of constant impressed emf is changed from zero to infinity give a circular locus, with various interesting characteristics, for which a first approximation theory is given.

II. The rectangular plot of motional reactance and motional resistance, against angular velocity of constant impressed emf, give curves somewhat analagous to the curves of index of refraction and absorption of light in an optical medium, in the neighborhood of an absorption band.

(6) The power taken by a telephone receiver when sounding at 0.3 volt applied voltage may exceed by 68 per cent the power taken from the same emf when the diaphragm is damped.

Proposes Tax for Iowa Telephones

With the proposal to levy an annual rental tax of $1 per pole and $1 per mile of underground wire, as well as the regulation of rates for service, Mayor James R. Hanna, of Des Moines, began his campaign against the Iowa Telephone Company to secure adequate compensation for the privilege of operating in Des Moines.

In presenting the measure to the city council, Mayor Hanna gave the amount of taxes paid by each public service corporation to the city of Des Moines. While the telephone company paid but $1,967.66 in taxes this year, the other corporations will pay in the following taxes this month: Des Moines City Railway Company, $43,396.43 on a valuation of $2,000,000; Des Moines Water Company, $31,428.76 on a valuation of $1,450,000; Des Moines Gas Company, $29,261.26 on a valuation of $1,350,000; Des Moines Electric Company, $20,495.86 on a valuation of $950,000. The value of the telephone equipment in Des Moines is more than $2,000,000, it is said.

Municipal Telephone System Proposed

The first of a series of ordinances necessary to bring about the establishment of a municipal telephone system in San Francisco is reported to have been submitted by the public utilities committee of the council to the supervisors. At an initiative election held last March the people decided, by a vote of 21,174 to 10,353, in favor of the project. Subsequently the ordinances submitted at that election were held to have been illegally drawn, but in spite of this the city attorney is said to have declared that, since the people spoke in favor of the policy, the question of a bond issue must now be submitted at a referendum election. The ordinance now submitted declares that the public requires a municipal telephone system to be operated and maintained by the city and county, and directs the Board of Public Works to prepare plans and estimates.

Telephone Merger Embarrasses City

It is estimated that it will cost the city of Birmingham, Ala., $50,000 to put in 500 new poles and rearrange the fire alarm system of the city as a result of the merger of the Peoples' Telephone and the Southern Bell Companies. There was a clause in the old franchise of the Peoples Home Telephone Company that the company could not sell its franchise or equipment to another company and that in the event the company quit business, its properties were to revert to the city. The commission allowed the sale and the properties did not "revert" and now the city must pay out something like $50,000 as a result, according to the general belief at the city hall among the officials who have studied the matter.

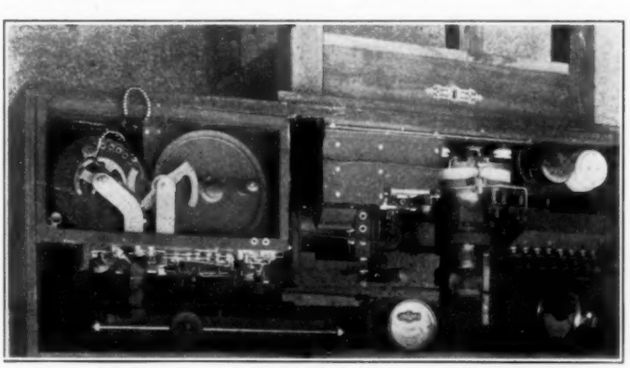
The Vielton System of Wireless

By Frank C. Perkins

THE accompanying illustrations and drawings indicate the methods of operation of the Vielton stations for wireless telegraph and telephone transmission and show the connections and details of construction of the electrical equipment. The Vielton type sender was developed by H. Rein and Dr. Eugen Nesper, with assistance of H. Prawitz, at the Berlin laboratory of C. Lorenz Actiengesellschaft, to whom the writer is indebted for the accompanying photographs and data of this equipment.

These German wireless engineers held that it was out of the question for the transmission of sound signals without wires to employ Marconi's arrangement for infrequent spark discharges, *i.e.*, with about 30 to 100 sparks per second. The number of discharges was far too small to make any impression whatever on the human ear at the receiver by means of the waves produced. For musical notes it is necessary to have at least 300 discharges per second or more. It was not possible to obtain such a high number of discharges with the old arrangements for producing sparks, because the spark gap passes current for too long a time after a discharge has taken place and a considerable time elapses before the gap is de-ionised and ready for a fresh discharge.

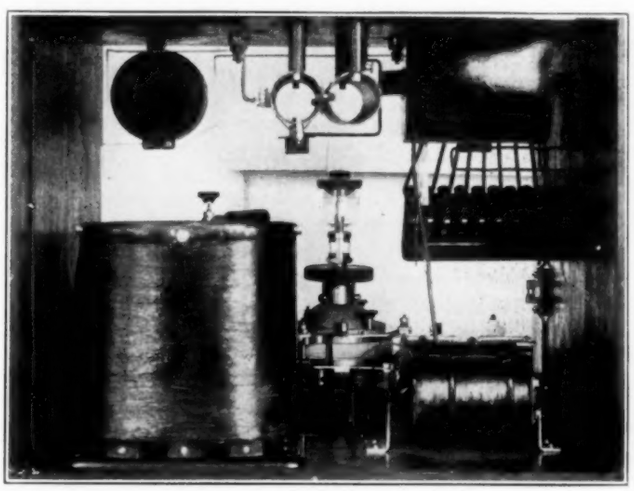
Dr. Nesper holds that one could not, therefore, expect any attempts to increase the number of sparks with devices of this kind to be successful. Even with metal gas spark gaps it was impossible to get a very much larger number of sparks that would work safely. There was also another disadvantage. In order to radiate the wave as quickly as possible it was necessary to have a rigid connection between the exciter circuit and the aerial conductors. The result



Portable Vielton Sending and Receiving Equipment.

was that fluctuations were produced at the sender and the aerial wire radiated not only one wave, but two and, under certain circumstances, even three.

It is maintained that conditions were altered, however, when it became possible to produce impulse fluctuations with greater energy, not only for testing purposes, but also for the senders of radiotelegraphy. For the present purpose the circuit containing the discharging gap should produce just one discharge impulse and the second system receiving the impulse should be allowed to swing freely, being damped as little as possible. The discharging gap for impulses was arranged to be de-ionised immediately after the impulse, thus enabling the number of discharges to be increased without any limit, and at the same time preventing energy from returning from the system that received the impulse, back into the system in which the impulse was produced; the circuit of the latter being broken in the gap in a complete and abrupt manner. One could therefore choose a number



Complete Vielton Sender.

of discharges through which a musical note was sounded in the receiver.

Generally the number of discharges employed for this purpose are of the order of 1,000 per second. One cannot regulate the number of discharges (and thus the note in the receiver) by any other means than by altering the frequency of the alternating current feeding the discharging gap, by inserting an interrupter in the antenna, or by connecting up the discharging circuit so as to obtain a rhythmical radiation of waves.

These German engineers maintain that these arrangements are cumbersome and have the disadvantage of making it impossible to vary the number of discharges quickly, therefore the note itself is not altered immediately. Apart from wave discrimination, sound signals and signs are very well adapted for the greatest independence from atmospheric discharges, and it becomes indispensable to provide for a rapid tone variation on this account, and also to prevent disturbances from other stations. This desirable immediate adjustment is obtained by means of the following Vielton arrangement, in an exceedingly simple manner. One can use either continuous current or low frequency single-phase current and the adjustment made immediately causes a variation in the tone.

The discharge gap, which must be suitable for impulse purposes, is usually connected in parallel to one oscillating system; but in this case there are two of these systems, one of which is tuned to a low fre-

quency according to the note that is wanted (Duddell system), and controls the frequent groups of impulses of the second (impulse system). The actual sending circuit (antenna) is jointed to the impulse system, and the coupling between the two can be made as rigid as may be desired. The effect on the antenna is always percussive and therefore a sound is produced by its radiation.

Fig. 1 shows the connection of the Vielton sender. At *a* will be noted the terminals from which one can

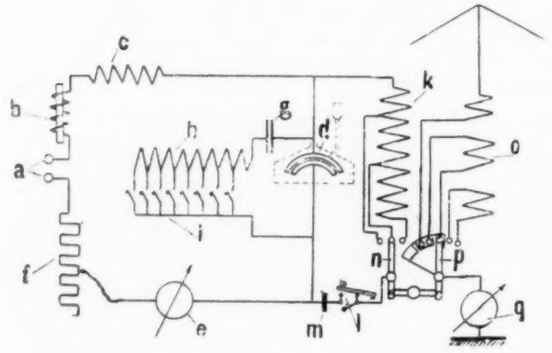


Fig. 2.

take continuous current or low frequency alternating current; *b* is a chocking coil with a core of sheet iron; *c* is a chocking coil wound on a cardboard cylinder; *d* is a discharging gap; *e* a hot wire instrument and *f* an adjustable resistance.

When using low frequency alternating current no resistance is required and a transformer is used for raising the pressure as required. The self-induction coils *b* and *c* mentioned above and also the resistance *f* are used together with the condenser circuits mentioned later for producing a wave current which corresponds to the rhythm of the note and its oscillations. Under certain conditions and with a resistance *f* of a larger capacity, the coil *c* can be omitted altogether.

Parallel to the discharge gap *d* is the Duddell circuit *d, g, h, i, d*, and the current circuit *d, k, n, l, m, d*. The Duddell circuit includes a large condenser *g* and a coil *h* with branches according to the number of notes wanted, each branch of the coil being connected to contacts *i* for inserting parts of the coil either temporarily or permanently. All these parts of coil *h* are tuned with condenser *g* for a certain frequency. Compared with the high frequency in the circuit the oscillations produced in this manner have a low frequency. The impulse circuit is composed of a coil *k* with branches and a switch *n* for producing say three definite wave lengths, a key with short-circuiting device *l* and a condenser *m*.

The waves produced in the impulse circuit when the discharge gap is short circuited should correspond as nearly as possible to the waves radiated from the antenna. As, however, the size of condenser *m* may not sink below a certain valve there is generally, with short waves especially, a very small self induction left for coupling the antenna, In the present case a wave of about 400 *m* must be produced by only one turn of coil *k* and this is all that can be used for coupling the antenna coil *o*.

In this design the sender is arranged to work with three definite lengths of waves. In order to simplify the working condition an antenna coil switch p is provided which is mechanically connected to the impulse coil switch *n* and is moved together with the same. A single manipulation is therefore sufficient for varying the wave length of the impulse circuit as well as the antenna; *q* is a hot-wire instrument in the antenna circuit *r*.

It is held that the series self-induction coils, resistances and self-inductances and capacities in parallel to the discharge gap are all dimensioned to produce the following waves. The condenser in the impulse circuit is much smaller than the condenser in the tone circuit and the self-induction of the former circuit is also much smaller than that of the latter; therefore the impulse condenser is charged at a much quicker rate than the tone condenser. The discharge takes place in the form of numerous discharge impulses, because the discharge gap is arranged for frequent impulse discharges. In the meantime the large tone circuit condenser has been charged and now the oscillations in the tone circuit will commence. This swinging process is of a secondary nature owing to the dimensions of parts composing the circuit and owing to the discharge gap, which can produce arc oscillations.

The drawing Fig. 2 shows how the oscillations probably work together. The frequent discharges of the impulse circuit with a constant amplitude are noted at *A*. These impulse discharges will continue so long as the current curve of the tone circuit remains below the zero line. *B* is the flow of the tone circuit, *C* is the continuous current line.

It is maintained that the gaps between impulse periods *D* and the note itself depend on the frequency of the tone circuit and are varied by altering the number of periods. In other words the impulse circuit is

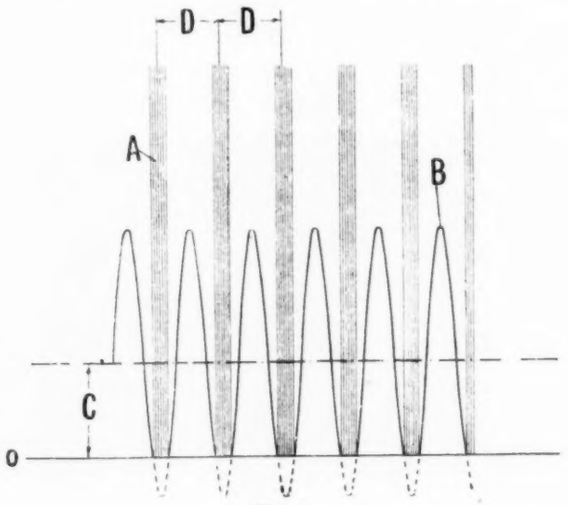


Fig. 1.

controlled by the tone circuit. The impulses produced in the impulse circuit are transmitted to the antenna, and the latter caused to swing, radiating single waves according to the damping action.

There is no difficulty in telephoning by means of the arrangement shown in the drawing, but the tone circuit must be opened for this purpose. One can then insert a microphone into the antenna circuit. After watching the peculiarities of the oscillations in the incandescent lights of the oscillograph one will

observe that according to the above remarks the oscillations in the sound circuits are continuous and similar to those taken by the Poulsen arc (light arc oscillations of a secondary nature). The impulse oscillations in the impulse circuit have amplitudes of similar values.

By watching the analyser one can check the height of the note and distinctness at the sending station very conveniently. As the design of the analyser is small, one can easily adopt it also for small stations.

The accompanying photographs show the Vielton sending and receiving station of a portable design, the diagram of connections being noted in drawing Fig. 1 of the sending apparatus. The discharging gap noted in the center of the photograph is of Scheller principle and has two almost hemispherically shaped metal parts between which the discharge takes place. These discharges consist first of arc oscillations of a secondary nature in the Duddell circuit, and second of frequent impulse discharge of the impulse circuit, which is contained in an airtight case.

There is an arrangement provided for enabling methylated spirits to drop into the discharge chamber. This is done in order to obtain the necessary atmosphere of hydrogen for cooling purposes. The design

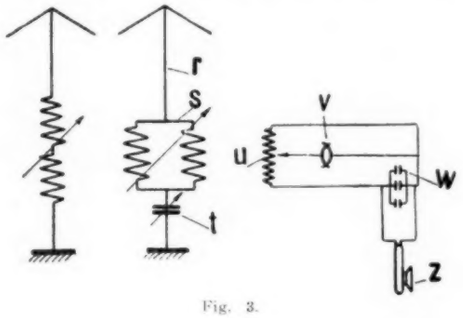


Fig. 3.

is such that by means of a slight pressure on the projection of the top metal electrode for adjusting the discharging gap the arc is ignited in case it should have gone out.

The amount of energy which can be dealt with in one discharging gap is limited, and when it is not sufficient one can use several gaps which are operated by means of a single handle; the same device is also employed when using single-phase current of low frequency.

The mica condensers in the sounding circuit have metal sheets, the space taken up being very small because the pressures to be dealt with are low and the mica block design lends itself for this purpose. Apart from electrical advantages such as a limited damping effect, this type of condenser is mechanically very strong and unbreakable. This is an important point in the case of portable stations.

It is of interest to note that the sounding coil seen in the photograph has contacts arranged similar to the key board of a piano. In order to make the design as compact as possible, which is not really a difficult matter, owing to the relatively small frequencies of the Duddell circuit, the sounding coil is filled with thin sheet-iron plates. The frequency and therefore the note will depend on the strength of the current in the coil, but the differences in current are so slight that there is practically no difference in the notes obtained.

It will be seen that the impulse circuit consists of a mica block condenser in a case beneath the key and a coil made of copper tubing—the latter is adjustable by means of a lever for the purpose of coupling the antenna as required. Generally, however, the antenna can be connected up permanently and the adjustable coupling referred to is only used for varying the energy.

To obtain a continuous scale of waves for the sender one can adopt either a cylindrical or flat coil variometer; these instruments are arranged to alter simultaneously both the wave lengths of the impulse circuit and those of the antenna. The only reason for which this is required is to get the largest possible amount of energy in the antenna. When the apparatus is not tuned there are no coupling waves, but then the energy of the impulse circuit condenser is not fully made use of.

The receiver is constructed on the Adelmann principle noted diagrammatically in drawing Fig. 3. The receiver is designed in such a way that merely by turning a hand-wheel throwing over a change-over switch one can run over a scale of waves from about 200 to 2,500 m. The receiver proper is a thermo-electric cell.

As indicated in Fig. 3, *r* is an antenna; *s* is the receiving variometer; *t* the condenser; *u* the detector coupling coil, *v* the detector; *w* three condensers turned for varying capacities which can be connected in parallel to the telephone *z*. These conditions are made when receiving waves of small lengths. For receiving longer waves the variometer coils *s* are connected in series as shown on the left in diagram Fig. 3. As seen in the photograph of the receiver there is an adjustable condenser with handle for moving the variometer coils and the detector coupling coil through intermediate parts. The outer parts of the last mentioned coils are seen on the right hand side at the bottom of the photograph, which also shows the adjustable detector coupling. The receiving arrangement mentioned in the beginning, involving an interrupter, is not adopted for the sets supplied, because the cell alone is quite sufficient for receiving purposes.

The distances which can be bridged over without wires by means of the Vielton sending and receiving apparatus described, depend largely on the antenna and on the strength of the current in the same. It is said that one can communicate over distances more than 50 km in a reliable manner with small screened antennas about 20 m. high and a capacity of the antenna for the lowest wave of about 200 m. The current in the aerial conductor was in this case on an average 2.6 amperes at a primary current of 1.8 amperes.

Dr. Eugen Nesper states that with the same primary current, but with a larger screened antenna with a minimum wave of about 500m, the current in the antenna amounted to 4.5 amperes, and it was possible to maintain distinct communications between senders and receivers over a distance of 200 km. He holds that to a certain extent, the longer the antenna is made the greater will be the strength of the current in the antenna for the distance to be bridged over, while the total efficiency of the whole installation is also increased accordingly.

The Telephone Scrap Book

A Telephone Courtesy Reminder

ESTIMATES of public-utility corporations formed by the local public are too often based upon individual instances of contact with some company employee over the counter or at the telephone. With the latter instrument the busy clerk or electrical man is sometimes tempted to be brusk and impatient in listening to the customer's complaint, and the offense

COURTESY
It pays, because the Public is entitled to it and have a right to expect it
Because it makes friends for you and the Company, and good friends
are valuable assets to you personally and the Company.
Because it reduces the friction between the
Company and the Public.
PLEASE KEEP THIS CARD ON
THE TELEPHONE TRANSMITTER
T. M. E. R. & L. Co.
Because it gives you a personal satisfaction
to have done the right thing.
Because it raises your standing with the Company. The Man
agement desires that all employes who come in touch with the Public,
should be uniformly courteous and cheerful when dealing with its patrons.

Courtesy Reminder Attached to Telephone Transmitter.

thus thoughtlessly given is made all the worse by the fact that the customer fails to understand the pressure in the office. Being far away at the end of the line, he feels himself helpless in getting the information or satisfaction he desires, and thus a "grouch" is developed. Despite its great benefit as a convenience, the telephone is still a temptation to impersonal discourtesy, and this tendency the public-service company which desires to hold the respect of the community must take means to prevent.

On each of the 500 telephones comprising the private branch exchanges of the Milwaukee Electric Railway & Light Company "courtesy" mouthpiece cards have been attached, says the *Electrical World*, affording constant reminders of the company's wise policy of demanding respectful audience to every telephone caller as well as to personal visitors at its offices. The circular cards, with central holes for attaching under the mouthpiece, carry the title word "Courtesy" in large letters, followed by these observations: "It pays because the public is entitled to it and has a right to expect it; because it makes valuable friends for you and for the company, and good friends are valuable assets to you personally and to the company; because it reduces friction between the company and the public; because it gives you a personal satisfaction to have done the right thing; because it raises your standing with the company. The management desires that all employees who come in contact with the public should be uniformly courteous and cheerful when dealing with its patrons." The cards are printed in three colors, blue, red and green, and carry a note of instruction, "Please keep this card on the telephone transmitter."

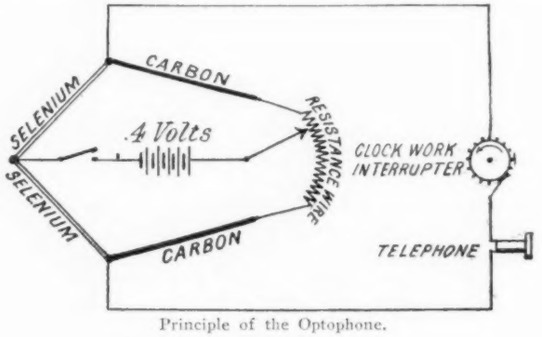
Light Made Audible

THE interest which was widely displayed in Mr. Fournier d'Albe's new invention at the time the original model was first submitted to members of the Royal Society in London, some months ago, has been intensified by the exhibition recently made of the improved apparatus at the optical convention in South Kensington, says P. F. Mottelay in the *Scientific American*.

The new apparatus actually enables the totally blind, among other results, to locate accurately any window or open bright light, to discover readily the shadows of objects passing between them and the light, to discover variations in light such as are produced by clouds passing over the sun, and to locate brightly illuminated objects, such as, for instance, people dressed in white.

The action of the instrument is based upon the peculiar property of selenium of changing its electrical conductivity under the influence of light. This property is utilized for producing an electric current, which is interrupted by a special clockwork interrupter, and so made audible in a telephone. Thus the eye is replaced by the ear as a detector of light. The improved instrument is a differential one, and as shown in accompanying diagram, contains two sensitive selenium surfaces, which form two of the resistances. It is specially designed to indicate contrasts, and is, therefore, best adapted for discovering objects, independently of the intensity of the light, though the brightest light naturally gives the quickest and most certain indications.

It consists of the camera-like box, ten inches long, three inches wide and four inches deep. To work it,



Principle of the Optophone.

it is necessary only to attach the telephone to one ear by means of the head-band, which latter should be slipped over the top of the head so as to hold firmly and enable the hands to remain free. The clockwork is then wound up by means of a small handle and a rod is moved along the slit until a purring sound is heard in the telephone. When this is the case, the iris diaphragm is closed down to its smallest size and the optophone is pointed (as one would a camera) toward

some region of the open sky—though not to the sun, of course. The rod which controls the wire resistance should thereupon be moved until the purring becomes as faint as possible; should, however, absolute silence not be obtained in this way, the sliding lid must be opened and the carbon resistance adjusted until perfect silence is procured. The instrument is now in its most sensitive state. The passage of the hand or other object across the aperture is indicated by a purring sound, the loudest sound indicating the passage of the edges, where the contrast is greatest. The full effect takes a few seconds to develop, and slow movements are, therefore, more easily discovered than rapid ones. In a bright light, however, even the swiftest shadow is discoverable. Prolonged exposure to a bright light "blinds" the optophone just as it blinds the human eye, and some repose is required to let it regain its sensitiveness for faint light. In feeble light, the iris diaphragm should be opened to its widest extent. A gentleman who tried the optophone found that a glimpse out of the window sounded like a cinematograph reeling off a film. The ticking sank almost into silence as the receiving tube was held in the shadow of the table, and leaped into a lively rattle when placed against an electric light bulb.

If you are blindfolded and place the receivers to your ears, and a piece of blotting paper is placed between the box and an incandescent lamp, you hear a ticking or grating sound; in fact, you hear the shadow passing.

On a moonlight night you hear the moon, while the summer sun makes a tremendous noise like a cataract.

The optophone can locate the light of stars invisible through the telescope.

The telephones used are similar to those employed for wireless telegraphy, and are capable of detecting a current of a quarter of a micro-ampere when interrupted by clockwork. The carbon resistances are 1,000 to 2,000 ohms each. In the new differential optophone, two selenium cells are balanced against two carbon resistances in a Wheatsone bridge arrangement. When directed toward any uniformly lighted surface, whether bright or dark, there is silence; but when the image of the edge of a bright object falls upon the line dividing the two selenium cells, one of the latter is illuminated while the other is in darkness, and the contrast thus secured gives a striking indication of the whereabouts of the edge. This is what the stone-blind want—to find where an object begins or leaves off.

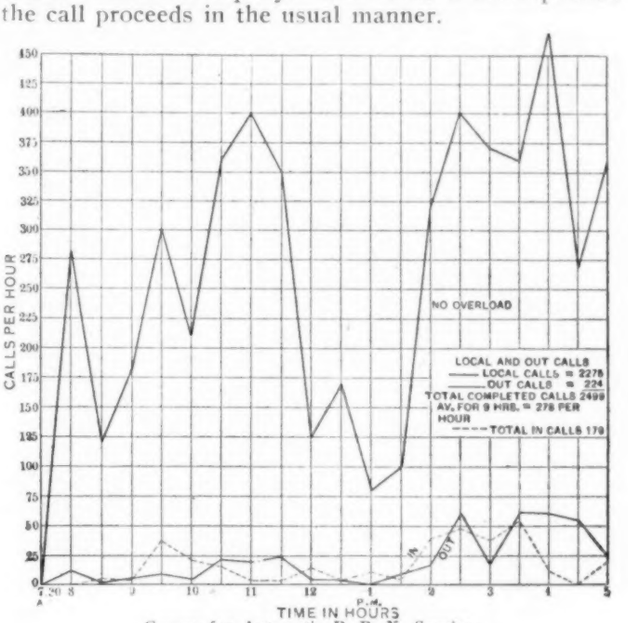
Performance of an Automatic PBX

IN discussing a paper by Gerald Deakin before the A. I. E. E., W. Lee Campbell, of Chicago, gives an interesting description of the automatic private branch exchange installed in the factory of the company making this apparatus, and connected by trunks to the public automatic exchange of approximately 30,000 stations and eight offices operated by the Illinois Tunnel Company in Chicago.

This private branch exchange switchboard serves 100 individual line telephones and 12 extension telephones, and is equipped with 100 line switches, 10 first selector switches, 10 connector switches for completing local calls, three connector switches for completing incoming trunk calls, and three repeaters for outgoing trunk calls. The three incoming trunks each terminate in one of the connector switches, just mentioned, at the private branch board and in fourth selector banks at the Brooks office of the Illinois Tunnel Company. They are also equipped with repeaters at the Brooks office.

The three outgoing trunks each terminate in first selector banks at the private branch board, where they are equipped with repeaters, and terminate in regular line switches at the Brooks office.

Local or intercommunicating calls in the company's factory are made by using three figure numbers. These numbers run from 100 to 199. Outgoing calls are made by prefixing the Figure 2 to any number taken from the Illinois Tunnel Company's public directory. The purpose of the prefix is, of course, to put the private branch exchange line into connection with an idle trunk line to the Brooks exchange of the Illinois Tunnel Company. After that is accomplished the call proceeds in the usual manner.



Curves for Automatic P. B. X. Service.

Considerably over half the private branch stations, however, are not allowed to send or receive outside calls. Each employee, whose service is restricted to intercommunicating service, is automatically prevented from making outside calls by an attachment, which, whenever he calls the prefix 2, keeps him from securing a connection with the trunk, and gives the buzzing busy signal.

The numbers of officers or employees of the company, who are allowed to receive incoming calls, appear in the public directory with a prefix. For example, the number of the station which is locally 170 appears in the public directory 5891-70. A subscriber to the Illinois Tunnel Company's System, when calling 5891-70, operates a first selector, second selector, third selector and a fourth selector in the public system, when calling the first four figures of the above number, that is 5891. This puts his line in connection with an idle trunk to one of the three incoming trunk connector switches on the private branch board, so that when he calls the last two figures, that is 70, this connector switch is operated and extends the connection to telephone No. 70.

The automatic ringing interrupter, which serves the three incoming connector switches, is arranged differently from that which serves the connector switches which handle local calls, so that when a local telephone is being rung on account of a call coming in from the outside, the party receiving the call is aware of the fact.

The circuits in connection with the three outgoing trunks, from the branch board, are so arranged that if one of the subscribers should attempt to make an outgoing call when one of the three trunks are busy, he will receive the busy signal so soon as he turns his dial from finger hole No. 2, which he does in attempting to secure a trunk.

The incoming trunks from the public exchange are arranged in the same way; that is, if any public exchange subscriber calls 5891, when all three of the incoming trunks are busy, he will receive the busy signal.

The heavy load which a small automatic switchboard of this type carries successfully, and the high efficiency of small groups of automatic switchboard trunks are attested by the curves in the accompanying figure.

One of these curves shows the intercommunicating calls per hour made from the opening of the factory at 7:30 a. m. until the closing at 5:00 p. m. Another shows calls per hour received on the incoming trunks, and a third shows calls per hour sent over the outgoing trunks.

It will be noted that the total number of local calls made during the day was 2,275, the total number of out calls sent was 224, making the total number of originated calls 2,499.

Between the hours of 3:30 and 4:30 p. m. (the busy hour of the day) the group of 10 connectors for completing local connections handled a total of over 400 calls, without being once over-loaded. Similar very high efficiencies are shown during the busy hours for the small incoming and outgoing trunk groups.

A number of busy hour local calls were timed with a stop watch, with the following results:

Time required to call	3.5 seconds
Time required for called party to answer	8.1 seconds
Time spent in conversation	30.1 seconds
Average time required for each connection, total	41.7 seconds

Selenium in Wireless Telephony

NOT long after Willoughby Smith's discovery, various experimentors sought practical applications of the property possessed by selenium of varying its electrical resistance under the influence of light. Among the first of these was Alexander Graham Bell, who, some twenty-seven years ago, made interesting experiments with his radiophone, a diagram of which is shown in Fig. 1, for the transmission of speech.

In this arrangement, a mica or glass diaphragm, *d*, with a silver coating reflects a powerful beam of light upon a selenium cell from some luminous sources, placed at the focus of a parabolic reflector, the cell being connected to a telephone receiver and battery. Words spoken into the mouthpiece behind the diaphragm set the latter in vibration and causes pulsations in the reflected light upon the selenium cell *C*, thus producing corresponding variations in its resistance and reproducing audible sounds in the telephone receiver *R*. This device was only used for transmitting speech over comparatively short distances (213 meters).

Variations in intensity of the beam of light, which correspond to particular sound waves, may be produced in several ways. The best method employs the "speaking arc" which, when placed at the focus of a parabolic mirror would constitute the sending station of a wireless telephone system. An arc lamp, whose circuit is coupled with a telephone circuit, may be caused to emit sounds similar to those spoken into the transmitter of the telephone; and when used in this way is termed a speaking arc.

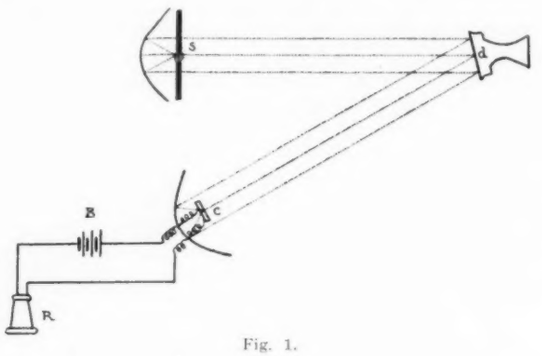


Fig. 1.

The most successful experiments which have been made with the speaking arc in conjunction with selenium cells are those of Ruhmer. The arrangement of one of his sending stations for the transmission of speech over a distance of five miles is shown in Fig. 2.

An arc lamp with a flaring arc one centimeter long is connected to a 220-volt circuit through two choke coils; the coils preventing the high-frequency currents produced by the voice from entering the line. This alternating current flows from the secondary winding of the induction coil through the condenser and arc and returns.

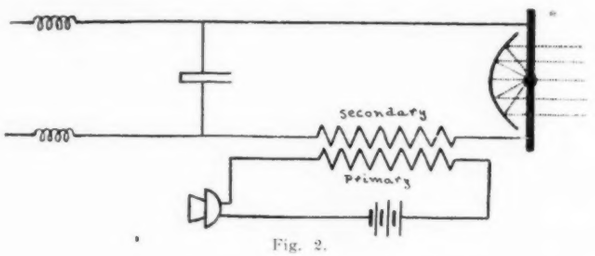


Fig. 2.

A carbon transmitter, in circuit with the primary winding and battery, superimposes waves, identical with the sound waves incident on the transmitter diaphragm, on the arc light circuit. The beam of light is reflected to some distant point, where it is received by a parabolic reflector, in the focus of which is placed a selenium cell, connected to a battery and sensitive telephone receiver. In the receiver are heard sounds similar to those at the sending station, this being accomplished by the variations of resistance of the selenium cell changing the intensity of the current flowing in the circuit. This investigator has conducted extensive experiments, both by night and by day, and in fog and rain, on the Wannsee, near Berlin, with remarkable success. With a large searchlight at the sending station he was able to transmit speech over a distance of 15 miles.

Method of Measuring Small Inductances

A SELF-INDUCTION may be measured in terms of a capacity by the method of Maxwell, according to S. Butterworth in a paper read before the Physical Society. The inductance is placed in the fourth arm of a balanced Wheatstone bridge (Fig. 1) and a condenser of capacity K is placed in parallel with the conjugate arm Q. The bridge will be balanced for variable currents, provided that $L/K = RQ = SP$, where L is the self-induction of the arm R.

Unless the condenser can be varied continuously, this method is tedious in operation. The following modifications have, therefore, been proposed:

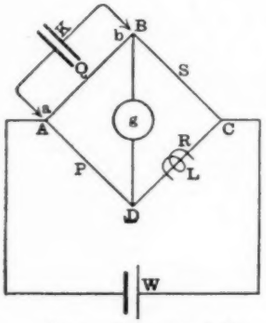


Fig. 1. Maxwell's Bridge.

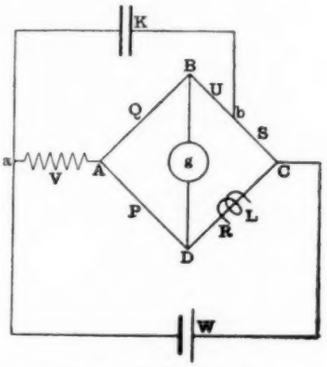


Fig. 2. Modified Bridge.

(*a*) If $L/K > RQ$, move the contact a along the battery arm. If V is the resistance intercepted between a and A, balance is attained when $Q.\ L/K = S\{V(P + Q) + PQ\}$. This modification is due to Anderson.

(*b*) If $L/K < RQ$, move the contact b along the S arm. If U is the resistance intercepted between b and B, balance is attained when $Q.\ L/K = P(Q + U)\ (S - U.)$

The former method is the more useful because the adjustment of V can be made without disturbing the steady current balance. Method (*b*) requires a slide wire in the arm S for rapid working. In order to avoid this the author has employed a combination of both methods. This is shown in Fig. 2.

With the notation of this figure the conditions for balance are $RQ = P(U + S)$, and $Q.\ L/K = S\{V(P + Q) + P(Q + U)\}$.

By a proper choice of S any inductance may be measured with a single condenser. Also, by adjusting V, the inductive balance may be made independently of the resistance balance.

Since the sensibility is always proportional to the inductance to be measured, it is important, especially in the case of low inductances, to use that arrangement which gives the maximum sensibility. It may be shown that the sensibility when using a vibration galvanometer as detector is increased by diminishing the frequency. With frequencies of the order of 100 per second and a capacity of 0.1 mfd., the condenser has practically no effect on the sensibility.

The source of E.M.F. may be treated as a battery of definite resistance (W) and the galvanometer as a definite resistance (g). The reactance of both these arms may also be made negligible. The conditions for maximum sensibility therefore become those for the Wheatstone bridge.

Hence with a given battery and galvanometer we must make

$$Q = \sqrt{Wg},\quad P = \sqrt{Rg\,\frac{R+W}{R+g}},$$

$$U + S = \sqrt{RW\,\frac{R+g}{R+W}}.$$

The resistance V is here included in W. The value of U is immaterial, but V must be as low as possible.

The experimental results show that it is easily possible to compare an inductance of the order of a few microhenries with a capacity of 0.1 mfd. and obtain an accuracy of at least one per cent. Much greater precision could no doubt be attained with additional precautions, viz., elimination of, or correction for, the residual inductances of the remaining arms, and for the leakage or absorption of the condenser; the use of a galvanometer of proper effective resistance and low ohmic resistance.

Fleming has used Anderson's method to measure small inductances by means of very low capacities, so that by combining the present method with that of Fleming it is possible to compare a low capacity (say, a Leyden jar) with the usual standard condensers.

Various Forms of the Dictophone

IT has been the impression of the public that the dictophone is a very complicated mechanism for automatically and unerringly recording the conversation carried on near it. In general the mechanism employed is quite simple and easily understood. In fact there is no new principle involved. The invention is an adaptation of well-known apparatus to a peculiar purpose or situation.

The instruments are of three general types. First is the type shown in Fig. 1, sometimes modified as shown in Fig. 2. This is the type of apparatus referred to by Detective Burns in his dynamiting cases. It is really nothing more than a simple telephone circuit arranged to convey sounds from the talking station shown on the left to the listening or recording station on the right. Sometimes the transmitter is mounted in an innocent-looking square or triangular box, divided into two compartments. Within one compartment is room enough for small size dry batteries and for storing the receiver when the apparatus is not in use or is being carried about from place to place; within the other is located the transmitter element. One wall of this second compartment of the box is, in reality, a thin diaphragm, with which is connected the microphone or resistance-varying element, usually a sensitive granular carbon transmitter button or cup. The size of the box is quite immaterial, but it is evident that the larger the diaphragm, the greater is the area of the sound-wave acting upon the transmitter element, and hence the better and stronger the reproduction of the transmitted sound at the receiving end of the line.

This is the type of instrument said to have been used by the famous Detective Burns and his associates in the MacNamara case and the so-called Lorimer-Hines bribery case. In each case the method of operating the device was somewhat as follows: Burns or any of his associated detectives "rigged up" a few rooms in a hotel. Appointments were made with suspects and accomplices. In one room in which the

conversation or consultation was held there was located the little transmitter disposed in a convenient but inconspicuous position; in the adjoining room the receiver of the instrument was placed, and an expert stenographer with the receiver to his ear took down the conversation carried on by the detective and the suspect in the other room. Thus, it is declared, very valuable evidence was gathered. Indeed, the success of the case is said to have depended upon the use of this ingenious device.

The use of this form of apparatus with slight modification has been applied to large auditoriums and churches. Instead of using a single transmitter and a single receiver, as shown in the figure, a number of transmitters placed at various points about the stage or pulpit are arranged to gather the sounds and transmit to persons at remote parts of the hall the voices

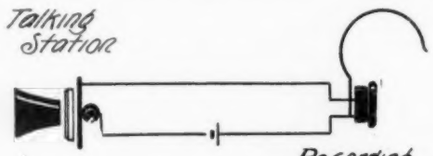


Fig. 1.

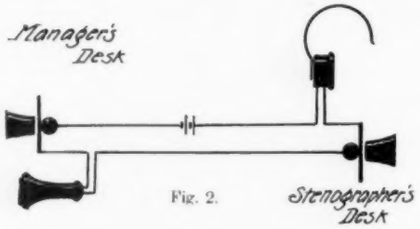


Fig. 2.

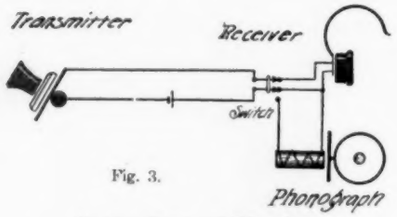


Fig. 3.

Various Forms of Dictophone.

of the speakers or the strains of the orchestra. As many receivers as may be required are connected into the circuit to reproduce the sound at the remote points.

In a modified form, as shown in Fig. 2, the apparatus is employed in large business offices between a manager's desk or office in one room and a stenographer's desk in another room for the purpose of expeditiously dictating letters and transmitting intelligence of any kind. In this case the apparatus is really nothing more than an intercommunicating telephone system, for speech can be transmitted in both directions. Various switches are employed for connecting the apparatus of any one of a number of stenographers' desks with the manager's instrument.

The second broad class is shown diagrammatically in Fig. 3. This is an arrangement combining the use of the telephone and phonograph. This type of instrument is often known as the "telephonograph," and in practice it assumes a number of different forms. In each case the principle is the same as that outlined in the figure. As soon as the telephone and the phonograph were invented the combined use of the two instruments suggested itself to a number of inventors. As early as February, 1889, there were public exhibitions of such use of the two instruments in combination. In a lecture before the Franklin Institute at Philadelphia Mr. William J. Hammer performed the following experiment: A phonograph at New York was set to talk into a carbon transmitter, sending current waves over a telephone line to Philadelphia, a distance of 103 miles, to the audience at the Franklin Institute. At that station a loud-speaking receiver talked into another phonograph and then in turn delivered to the amazed audience the tones of the original speaker in New York City.

No great practical use has been found for this combined instrument, due to the great difficulty of keeping a suitable surface constantly in motion ready to record the sound waves. Furthermore, much of the apparatus is too large and cumbersome to be conveniently portable, due largely to the size and weight of the motor mechanism for driving the cylinders. It was early proposed to apply this instrument to the ordinary telephone to keep a record of the conversations passing over the line. This was to be especially useful in keeping a record of these conversations for subsequent use in legal controversies. It would be too easy, however, to manufacture such a record. At present an application of such device is found in some systems of telephone exchanges. A continuously operating phonograph is used as a "busy-test." If the subscriber calls a busy line he is automatically connected at the central station with this phonograph, which continuously repeats the well-known ditty, "the line is busy, please call again." Another use of this type of instrument has been made in certain automatic fire-alarm installations. In this case thermostats are arranged to close a circuit at a predetermined temperature. This circuit controls the operation of a phonograph device, connecting it with the nearest telephone line. Arranged on the cylinder of this instrument is the message to be transmitted to the central station or to the nearest fire station. Such record may contain suitable words, as "there is a fire at No. 99 Park Row." The instrument is arranged first to signal central and then to repeat this message a number of times. "Central," upon receiving such a message, connects the line directly with fire headquarters and thus, automatically, an alarm is sent in almost instantaneously. With this arrangement it is evident that a subscriber would be apprised of the fire call if he were using the telephone line and would immediately stop his conversation and hang up his receiver to allow the call to continue to "central."

Joliet School Telephone System Leads

With the installation of a telephone system throughout the school, the Joliet Township High School has taken another step in advancement of other schools in the state. Recently the Chicago Telephone Company installed a modern switchboard connecting with each of the forty-five rooms. It is said that no other high school in the state has such a system. The work was done during vacation. Now telephonic connections can be had with any point in the city from any of the rooms. Superintendent J. Stanley Brown declared that the school officials are well pleased with the change.

Wiring Large Buildings for Telephones

By Frederick L. Rhodes*

IN modern office buildings, hotels and apartment houses large numbers of telephones are required. It would be inconvenient and impracticable to run a pair of wires through one of these large buildings each time a telephone is installed, in order to establish connection with the outside wire plant of the telephone system, as is ordinarily done when telephones are installed in residences or small business buildings. To overcome this difficulty, when the plans are prepared for an office building, hotel or apartment house, a forecast should be made of the probable future requirements of the building as a whole for telephone service, and facilities provided for a certain amount of cabling with the necessary terminals and subsidiary wiring. All large cities contain many buildings that are cabled and wired for telephone service according to a comprehensive plan and, of the smaller places, there are few that do not have some buildings of a character requiring more or less provision of this kind.

Building Plans Should Include Provision for Telephone Wiring.—Owing to the type of building construction generally employed, and the large number of telephones to be served, unless suitable facilities are provided in advance for accommodating the cables and wires, and for running them through the walls and floors, the work will either be unsightly in spite of all precautions to the contrary, or expensive and costly alterations will be required after the completion of the building to enable the wires to be effectively concealed.

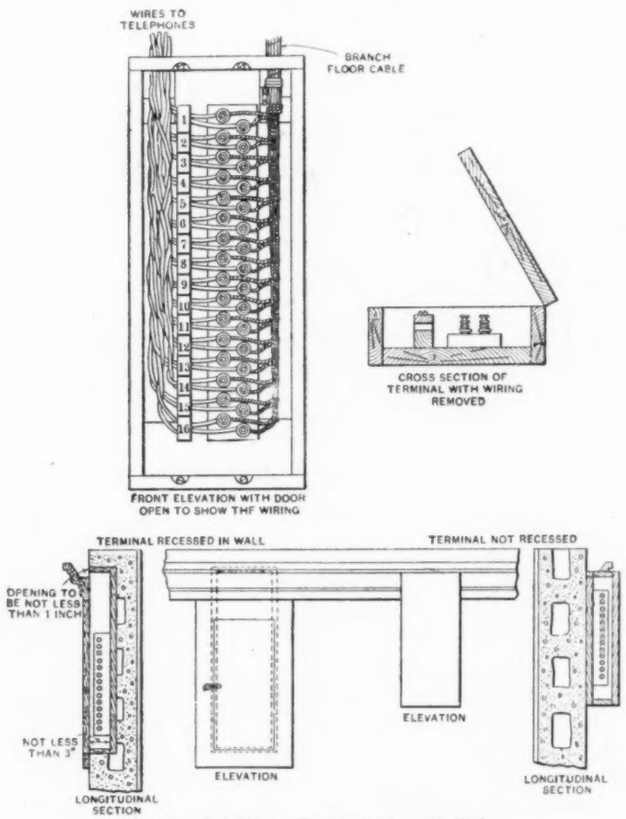


Fig. 1. Subsidiary Terminal Box—15 Pairs.

It is therefore of prime importance to owners and architects that, in preparing plans and specifications for office buildings, hotels or apartment houses, suitable arrangements should be made for such telephone wiring and terminal boxes as the character and use of the building will demand. As every large building to a certain extent presents problems of its own, advantageous and economical arrangements can frequently be suggested by those who are specially familiar with work of this kind. It is to the advantage of telephone companies as well as building owners to have adequate facilities provided for the cables and wires, and telephone companies are glad to place their experience freely at the disposal of those who are planning the erection of buildings that require special provisions to be made. It is now the general custom for architects to send for the telephone company's experts in these matters to give them such information as they need to plan this work in the best way.

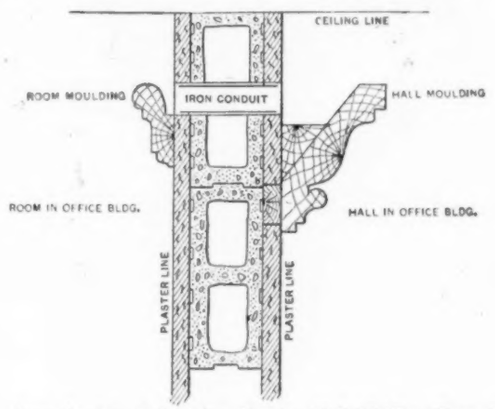


Fig. 2. Cross Section of Partition Showing Hall Molding, Room Molding and Partition Conduit.

Classification of Buildings.—In the following pages are described the general methods that have proved satisfactory for wiring buildings for telephone service. From this standpoint buildings may be divided into two classes:

1. Office and loft buildings.
2. Hotels and apartment houses.

The conditions that make a broad distinction between the two classes are these: In office and loft buildings the telephones do not remain fixed either in number or location for any extended period, varying with the requirements of the individual tenants who will use more or less of the telephone service according to their respective kinds of business. In hotels and apartment houses the number of telephones is fairly definitely fixed, being almost invariably one for each room in a hotel and one or two for each apartment in an apartment house.

*A paper presented at the 29th Annual Convention of the American Institute of Electrical Engineers, Boston, Mass.

The office or loft building requires a permanent cable system supplemented by a multitude of branches consisting of pairs of wires whose function it is to connect the individual telephones or private branch exchange switchboards with the permanent cable system. This permanent backbone of cable extends upward from the basement, branching out and terminating at suitable distributing points on the several floors. These distributing points or cable terminals must be sufficiently numerous and so located that the changing requirements of the tenants can readily be met by running individual pairs of wires as needed to connect the telephones with these terminals.

It is, therefore, apparent that an office building must have a more comprehensive and flexible system of wiring than a hotel or apartment house on account of the different characters of the telephone service required. In the office building only a portion of the wiring system is permanent. In a hotel or apartment house practically all of the wiring is permanent.

OFFICE BUILDINGS.

General Scheme of Wiring.—In large office buildings one or more cables from the nearest telephone

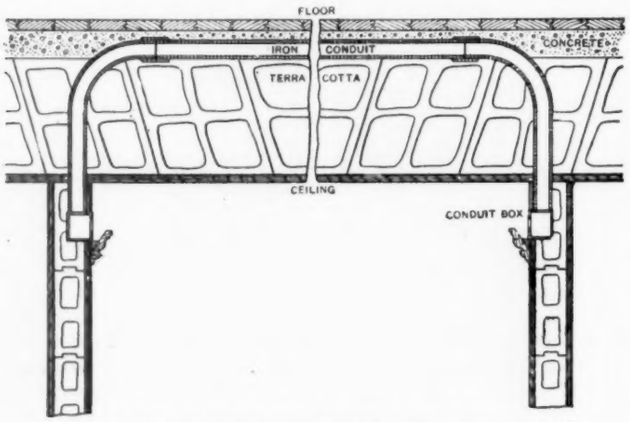


Fig. 3. Method of Placing Iron Conduit Across Ceiling of Hall.

central office are brought to some convenient point, usually in the basement of the building. At this point the house cable system begins. A main terminal box is furnished and placed by the telephone company at this point so that cross-connections can be made as required between pairs in the house cables and pairs in the central office cables.

These main terminal boxes in the case of large buildings are necessarily somewhat bulky and the question of the size of the box that will be needed in any particular case may well be taken up with the telephone company by the architect or builder in order that sufficient space for it can be provided in a convenient and appropriate location at the foot of the riser shaft or conduit as the case may be. A dry, clean and accessible place should be selected. In some sections of the country, where buildings are in localities subject to floods, it will be well to provide space above the basement so that the telephone service will not be interrupted due to water getting into the basement.

From the main terminal box one or more riser cables are run to the top of the building. The riser cables gradually diminish in size as they extend up through the building. From the riser cables, subsidiary or branch cables of proper size are taken to distributing centers on the several floors. The locations of these centers should be chosen so as to admit of the shortest practicable wire runs to the offices, without making objectionable work necessary to conceal the wires.

Each subsidiary cable ends in a subsidiary terminal box, the purpose of which is to enable connections to be made readily between the cable and the individual pairs of wires that are run to each telephone. These subsidiary terminal boxes when placed by the telephone company are fastened against the walls of corridors near the ceiling and constitute the ends of the permanent wire system. Not infrequently the owner of the building desires to own the subsidiary terminal boxes in order that he may provide recesses for these boxes and small doors to match the trim of the building so that the boxes will be concealed from view. Where the boxes are built into the walls it is important that they should be of ample capacity on account of the trouble and expense that would result if they should prove inadequate and have to be replaced. It is customary to allow a greater margin for growth where the boxes are built in than where they are merely fastened against the wall. Where a conduit system has been installed on the various floors for the purpose of distributing wires to each office, the subsidiary terminals are located at the centers of the conduit system. Fig. 1 shows a subsidiary terminal box, recessed in a corridor wall, under the molding, and also a subsidiary box placed against the wall under the molding.

Forecasting the Number of Telephones.—In forecasting the number of telephones that will probably be required in an office or loft building, the principal factors to be taken into account are the "renting floor area" of the building and the character of the business district in which it is situated, with special reference to its proximity to railway terminals, important streets and business centers.

Buildings in the financial district of a city ordinarily demand more telephones per unit of floor area than do buildings located in the commercial districts. In computing the "renting floor area," only the office floor space is considered; hallways, elevator shafts and light wells are omitted. In all cases a safe margin for growth must be allowed. The following table shows rough average figures for telephonic density in office and loft buildings, based on a large number of cases:

Kind of building	Character of district	Pairs of telephone wires per 1000 sq. ft. of renting area
Office	Financial	4 to 5
Office	Commercial	2½ to 3½
Loft	Commercial	1 to 2

Size of Riser Cables.—By basing the size of the riser cables on the renting area and the expected telephonic density as influenced by the character of the locality (checking this by a study of the probable number of offices and the requirements of prospective tenants) the cable system for any office or loft building may be planned with reasonable assurance that provision will be made for the maximum service required. On account of the requirements for battery feed wires and ringing current for private branch exchanges, the riser cables necessarily contain more pairs than do the cables that run from the building to the telephone central office.

Shafts or Conduits for Riser Cables.—In buildings

over 12 stories in height or in buildings of less height, where large riser cables are required, it is preferable to place the riser cables in suitable shafts rather than in conduits, as the advantage of having the cable protected by conduits is offset by the difficulty of installing and properly fastening the large cables in the conduits and making large complicated splices in the junction boxes that are required with a conduit system.

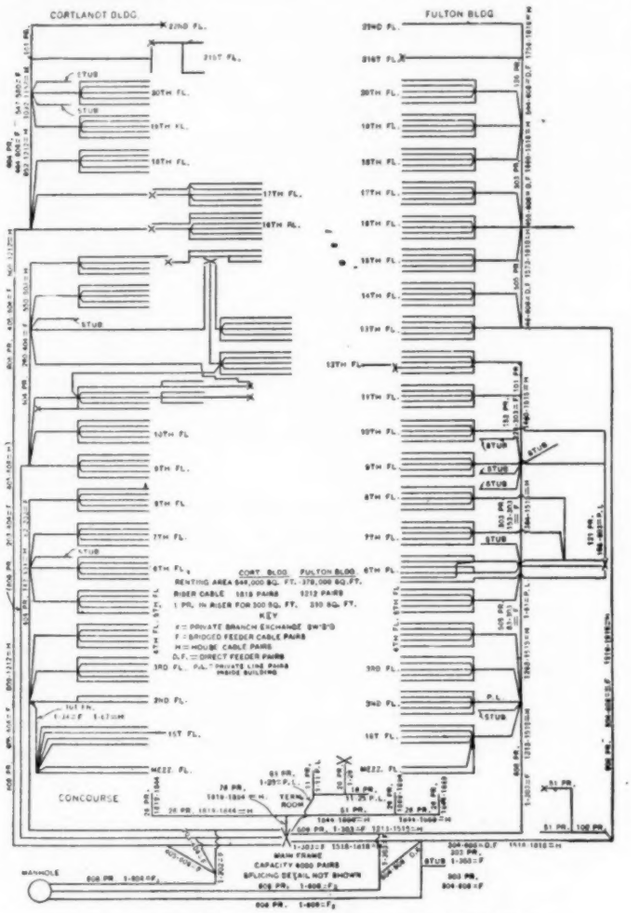


Fig. 4. Terminal Buildings, House Cable Distribution.

If properly installed a conduit system is the best equipment for buildings less than 12 stories in height where small cables are to be placed, as the cables are effectually protected against injury. It is important, however, to remember that the success of a conduit system for installing vertical cables depends entirely on a perfect installation. The conduits must be of proper size and if possible free from bends. If bends are absolutely necessary, they should be made with a radius not less than three feet. The junction boxes at splicing points must be at least two feet square and the conduits must enter the boxes adjacent to a side in order that the cable may be bent and placed in a horizontal position for splicing.

Cable Shafts.—Cable shafts should extend from the basement of the building to the top floor and should be easily accessible at each floor for the placing and splicing of the cables. Usually the shaft can best be located in a corridor partition, or in the wall of some public space leading out from the corridor, so that an opening can be made into the shaft from the corridor and covered with removable paneling or doors.

It is desirable to have a separate shaft for telephone cables and wires, as the placing of steam, water or gas pipes and light and power wires in the same shaft with the telephone cables renders the latter liable to injuries that may result in interrupting the telephone service.

Underground Cable Entrance to Building.—Repairing basement walls and their waterproofing, due to the necessity for cutting through them, can be avoided if architects will specify a three-inch iron pipe sleeve for each ultimate underground cable entering the building, these sleeves extending through the wall at the point of entrance. The location of the point of entrance should be taken up with the telephone company in order that it may suitably fit in with the underground conduit system outside the building.

Junction Boxes.—Riser cables ordinarily diminish in size as they go up the building. When a building is provided with conduits for both riser and subsidiary cables the conduit may diminish in size in the vertical section in the same relative manner as it is proposed to diminish the riser cable. Where a separate conduit is installed for each subsidiary cable a splice is required between the subsidiary and the main cable and a junction box is required wherever one of these splices must occur. These boxes should be approximately 24 inches square by five inches deep (inside dimensions) in order to enable the splices to be properly made and stowed away. In a system of this kind

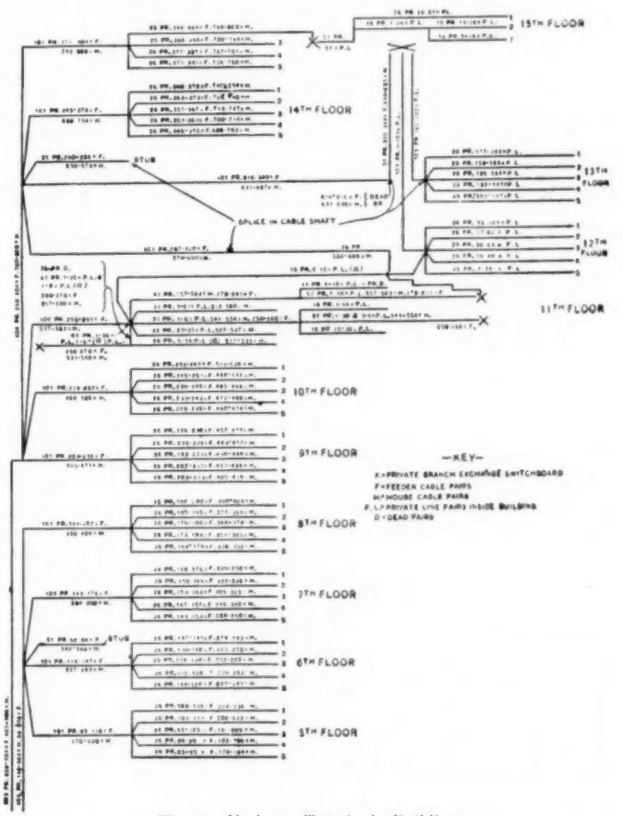


Fig. 5. Hudson Terminal Buildings.
Detailed distribution of cable pairs on the 5th to 15th floors, inclusive, in Cortlandt St. Building.

the subsidiary cables and the sections of the riser cable between floors are run separately and spliced in the junction boxes.

Terminal Boxes.—The terminal boxes in which the subsidiary cables end must be large enough to accommodate the necessary connecting blocks. In most cases, boxes 18 inches square by five inches deep (inside dimensions) are sufficiently large. These boxes are installed on each floor as near the wiring center as possible, and, where there is a conduit system on the floor, they are connected with each office by a ⅝-inch of ¾-inch conduit which ends in the office at an outlet located either at the baseboard or the molding. Outlets should be located at the baseboard when it is of wood. If the baseboard is of metal or marble the outlet should be located at the molding.

In many cases owners of buildings do not desire to install conduits from the subsidiary boxes on each floor to every office. By providing suitable moldings, properly arranged to carry the individual pairs between the subsidiary boxes and the offices, wiring that is practically concealed can be done without the expense of conduits, and as the wiring is permanent only as far as the subsidiary boxes, the system is flexible enough to allow a suitable distribution of cable wire among the various rooms on a floor.

Where this plan of wiring is employed the subsidiary boxes may be made smaller than where individual conduits to the rooms are installed. The following table shows the outside dimensions of the present standard sizes of subsidiary boxes:

Number of pairs of wires terminated in box		Height of box in inches	Width of box in inches	Depth of box in inches
Regular	Extra			
10	1	12½	6¼	2⅝
15	1	16	6½	2⅝
20	1	21	6¾	2⅞
30	2	16	12	2⅝
40	2	21	12½	2⅞

Figure 1 shows a front elevation and section of one

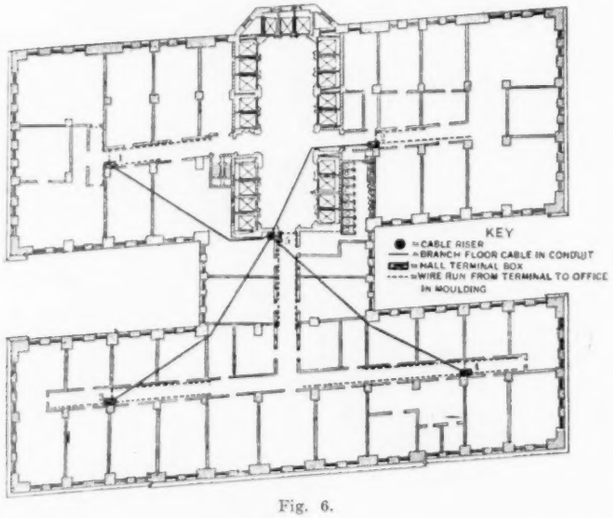


Fig. 6.

of these boxes. The equipment consists of a connecting block strip and a form or fanning strip. The connecting block is of insulating material and carries a pair of binding posts for each pair of cable wires to be terminated in the box. The form strip is of wood and serves merely as a guide to preserve an orderly arrangement for the individual twisted pairs that run from the telephone to the box. These twisted pairs pass through holes in the form strip and are secured under the nuts and washers of the binding posts as are also the wires of the cable.

Cross-Connecting Boxes.—Where a private branch exchange switchboard is to be installed, a cross-connecting box will be required. The wiring center in a case of this kind is at the cross-connecting box and not at the private branch exchange switchboard.

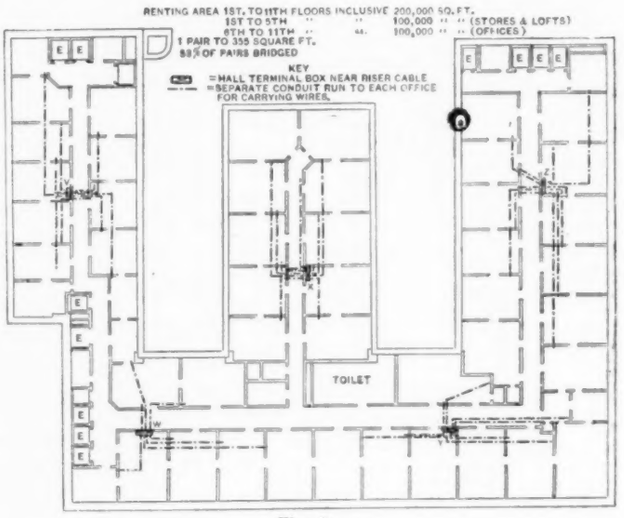

RENTING AREA 1ST. TO 11TH FLOORS INCLUSIVE 200,000 SQ. FT.
1ST TO 5TH " " 100,000 " " (STORES & LOFTS)
6TH TO 11TH " " 100,000 " " (OFFICES)
1 PAIR TO 355 SQUARE FT.
80% OF PAIRS BRIDGED
KEY
= HALL TERMINAL BOX NEAR RISER CABLE
= SEPARATE CONDUIT RUN TO EACH OFFICE FOR CARRYING WIRES.
TOILET

Fig. 7.

Use of Moldings.—As shown in Fig. 1, the subsidiary boxes are placed near the ceiling and wide shell molding, Fig. 2, should be provided in the halls for carrying the paired wires from the subsidiary boxes to the rooms. A smaller molding should also be provided in the individual rooms for carrying the wires to the particular locations desired. The space for the wires at the tops of these moldings should not be enclosed but should be left open. The object is to provide a continuous trough from each subsidiary box reaching out to every room that is to be fed from it. Figure 2 illustrates a section of one of these moldings.

Where it is necessary to make a concealed run across the ceiling of a hall, in order to avoid carrying exposed wires across the finished ceiling or to obviate making a circuitous run around the hall to reach rooms on the opposite side from the subsidiary box, conduit should be laid in the ceiling before the plastering is completed to enable a small cable to be carried across the hall to provide for such lines. (Fig. 3.)

Where the wires enter a room from a hall molding, a piece of ¾-inch conduit should be placed in the partition to enable the wires to be carried through it from the molding in the hall to the molding in the room. This avoids the necessity for drilling holes through the partition after the building is completed, which would be likely to result in damaging the finished wall. The conduit should either be lined with insulating material or the sharp edges around the inside of the pipe should be rounded off. (Fig. 2.)

Kind of Cable.—Paper insulated lead covered cables, such as are used by telephone companies in their outside plant, are the most desirable for use in building work. These cables are smaller and less costly for the same number of wires than cables of rubber insulated wires. With this type of cable all of the

terminals must be made with lead covered silk and cotton insulated cable, boiled out in beeswax or approved compound, and carefully shellaced, as the paper insulation will not stand handling if exposed, and moisture must be prevented from entering the paper insulated cable. Should the terminal of necessity be in a particularly damp location it must be made with rubber covered wires.

General Arrangement of Riser and Subsidiary Cables.—From what has already been said it will be seen that the general arrangement of riser and subsidiary cables is practically the same irrespective of whether conduits or shafts and moldings are provided.

The splicing of the subsidiary cables for each floor to the riser cable is usually done so that a given pair of wires in the riser cable is available for use on more than one floor. This is termed "bridging" the conductors and furnishes a multiple system of distribution. By this means the flexibility of the system is increased and fewer spare pairs need be provided in the riser cable than would be required if there were no "multipling."

From records of a large number of house cable systems it has been found that by bridging about two-thirds of the pairs in the riser cable at the subsidiary branches the most advantageous balancing of facilities is obtained. If less bridging is done it often happens that many of the subsidiary cables become congested before the riser cable. Owing to the use of standard size cable it is frequently necessary to make either riser or subsidiaries somewhat larger than the exact number indicated by the density study. The use of such cables may cause the proportion of bridging to vary from one-half to three-quarters.

In splicing the subsidiary cables to the riser cable in buildings of modern size, it is not economical to open the large riser cable on each floor. In such cases, the plan followed is to take out from the riser cable at one floor the small subsidiary cables for several floors and to carry them from that point up or down to their respective floors.

Methods of Installation.—If the riser cable is placed in a shaft the main cable and its subsidiary branches are often spliced together on the roof of the building or in some upper story and then lowered into place. In some cases the splicing is done in the telephone company's shop and the cable shipped to the building ready to be installed.

For supporting the cable a steel strand is used. Two or three wraps of iron wire are made about the cable at frequent intervals and these are attached to the strand by separating the individual wires of the latter and passing the tie wires through the interstices of the strand. If the subsidiary cables are more than about 30 feet in length only a short section of each is spliced to the riser cable before lowering. In this case the subsidiary branches are run and spliced to these stubs after the riser is put in place.

Special Conduit Work.—In the methods above described the facilities provide for locating the telephones on or near walls or partitions, as this is the most common location. It can sometimes be foreseen by owners or architects that telephones will be required at some distance from a wall or partition, as would be the case with a desk placed in the center of the room. Where an arrangement of this kind is desired the owner should provide a duct in the floor extending from the location of the telephone to the picture molding on the wall or to some other place easily accessible for wiring. A duct of this kind should end at the floor in a floor box covered with a flush plate.

It sometmes happens, particularly in buildings used by large corporations or firms, that entire undivided floors are occupied by large numbers of desks. Telephone service is frequently required at all, or a large part of these desks and the locations and arrangement of the desks on the floor may from time to time be changed. The floors of these buildings are often of fire-proof construction. To meet a situation of this kind adequately it is necessary to be able to

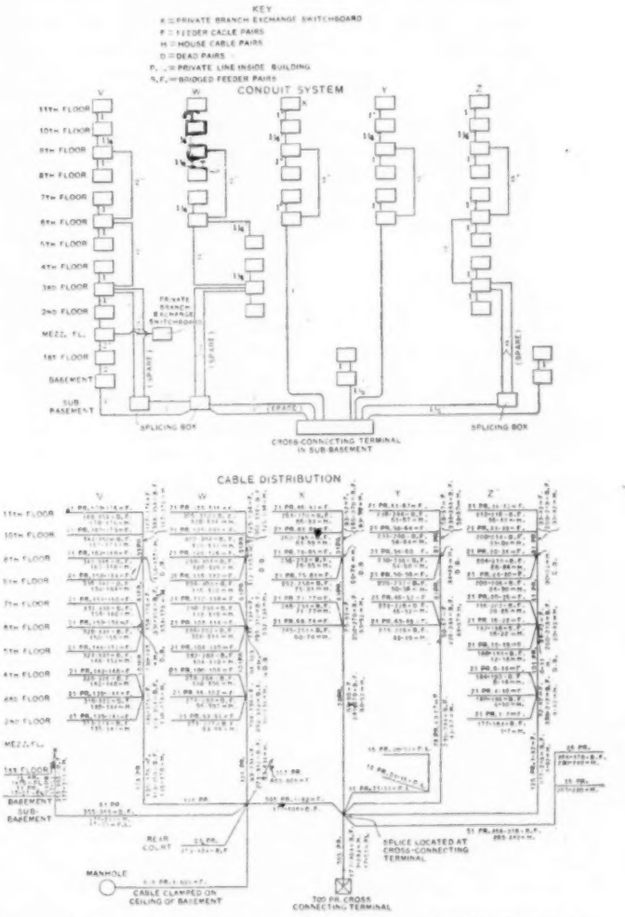


Fig. 8.—11-Story Office Building, Conduit System and Cable Distribution.

carry individual pairs of concealed wires to desks placed at any points on the floor, so that great difficulty and expense would be encountered in providing concealed wiring if suitable facilities admitting of the utmost flexibility were not provided in advance.

The best method of doing this is to carry branches from the riser cable in conduits to convenient building piers, placing subsidiary junction boxes at the bases of these piers. The entire floor is then provided with small floor outlets placed at the corners of squares about eight feet apart, each outlet being connected by conduit in the floor with the nearest subsidiary junction box at a building pier. Where the floors are not of fireproof construction, the individual pairs of wires

are run in small channels grooved out of the floor beams on their upper surface. The locations of these channels should be accurately marked above the finished floors. Small brass nails are convenient for this purpose. When a telephone is required at a desk the flooring over the nearest channel is cut through, thus establishing a connection through the channel with a subsidiary terminal, conveniently placed, the wires being fished through the channel in the ordinary manner.

Arrangement of Conductors to Insure Flexibility in Operating the System.—In order that the main terminal box may be as small as practicable the number of cross-connections to be made in it should be kept at a minimum. This is also important from maintenance considerations. To enable this to be done the method of distribution is arranged in a similar manner to that employed in other portions of the telephone plant. A certain number of pairs of wires in the riser cable are directly connected to the cable entering the building from the telephone exchange. These connections are made in a lead covered splice and the pairs of wires thus spliced directly through do not appear in the main terminal box.

Certain other pairs in the riser cable are brought to terminals in the main terminal box. The remainder of the pairs in the riser cable are directly spliced to pairs in the exchange cable and these same pairs are also brought out by means of a branch splice to terminals in the main terminal box. If there are any extra pairs in the exchange cable that are not directly spliced to pairs in the riser cable they also are terminated in the main terminal box.

This arrangement, if the pairs have been skilfully distributed, permits of great flexibility and reduces to a minimum the number of cross-connections required in the main terminal box. The pairs that are connected straight through from the exchange cable to the riser cable without appearing in the main terminal box are used for the direct line telephones in the building and for private branch exchange trunk lines. The pairs of the exchange cable that appear in both the main terminal box and the riser may be used, first at the various floor boxes in the event of the congestion of the direct exchange pairs that appear in these boxes, and second in the main terminal box for battery and generator circuits and for overflow of business, due to erratic growth in lines on the various floors in the building, by cross-connecting to the house cable conductors extending to these floors. House cable pairs terminating in the main terminal box are used for private lines and miscellaneous circuits and for providing battery and generator circuits between the box and the various private branch exchanges by cross-connecting to the exchange cable in the main box.

EXAMPLES OF OFFICE BUILDING WIRING.

The Hudson Terminal Buildings in New York City, extending from Cortlandt to Fulton streets, one block west from Broadway, afford an example of the facilities required for telephone service in the case of office buildings of the largest size. The two Terminal buildings are treated as a unit so far as the telephone wiring is concerned. Together they contain nearly a million square feet of renting area and at the present time have about 3,000 telephones. These data will indicate the magnitude of the wiring problem.

The cabling and wiring of these buildings is illustrated by the following figures:

Figure 4 is an elevation of the riser cables, showing the connections with the exchange cables and the general arrangement of the branch cables to each floor. Figure 5 is a detail elevation showing typical "multipling" of the branches from the risers to the floors and of the subsidiary cables on the floor. Figure 6 is a typical floor plan showing the locations of the riser cables, the floor cables, the floor terminals and the wire runs in the hall moldings to each office.

At the present time there are three 606-pair underground cables extending from the telephone central office to these buildings. The central office cables are spliced to the house cables near the main terminal. About 16 per cent of the pairs in the central office cables are connected directly to pairs in the riser cables that do not terminate at the main frame terminal of the buildings. The remaining 84 per cent of the pairs in the central office cables are bridged to pairs in the riser cables which also appear at the main frame terminal. All pairs from the central office cables that are directly connected to house cable pairs are marked *DF*. All pairs from the central office cables that are connected to house cable pairs that also appear at the main frame terminal are marked *F*. The balance of the pairs in the house cables (marked *H*) have no connection with pairs in the central office cables except by cross-connection at the main building terminal, where they may be connected as desired to pairs in the central office cables that are also bridged to riser cable pairs.

As new cables to the central office are added to meet the demand for additional telephone service in these buildings, the existing central office cable requiring relief will be left directly connected to the riser cable system and the bridged pairs will be transferred to the new cable.

The riser cables, of which there are five in all, are located in cable shafts beside the elevator shafts, Fig. 8. On each normal floor are provided conduits extending from the cable shaft to each of the five subsidiary terminals on that floor. In Fig. 8 these conduits and the subsidiary terminals are shown by solid lines. Broken lines represent the runs of individual twisted pairs of wires in moldings from the subsidiary floor terminals to each office on the floor.

On account of its complexity, the entire scheme of multiple distribution for these buildings is not shown in full detail. The principles are, however, illustrated in Fig. 5 which shows the complete lay-out of the distributing cables branching from two points of the riser cable system of the southernmost (Cortlandt) building and feeding from the fifth to the fifteenth floors, inclusive. The distribution for the fifth to eighth floors inclusive represents one of the simplest cases in these buildings. That for the ninth to fifteenth floors is one of the most complicated due to the special demands brought about by certain private branch exchange requirements.

In portions of these buildings, on account of private branch exchanges, some of the floor distributing branches from the riser cables that would be needed to supply individual tenants, are not required at the present time. Stubs containing the cable pairs that would normally appear on these floors are, however, provided and left in the cable shaft so that, merely by

splicing subsidiary cables to these stubs, service on these floors of a different character could readily be established if changed office conditions should render this necessary.

The requirements for telephone service in these buildings are so large that a main distributing frame is installed to act as the main building terminal. This frame serves the same purpose as the terminal box equipment shown in Fig. 1, namely to enable the pairs from the central office cables to end in a compact series of terminal lugs, and the pairs from the house cables in another series of terminal lugs; the lugs being so cross connection can readily be made between any pair arranged that, by short lengths of twisted pair wire, cross connection can readily be made between any pair brought to the frame from the central office cables, and any pair brought from the house cables. This permits great flexibility of distribution. In the "multipling" diagrams, Figs. 4 and 5, the numbering of the pairs in the house cable system is on the basis of two groups. All feeder pairs in the house cable system, whether directly spliced to pairs in the central office cables and not appearing at the main terminal or bridged to pairs in the central office cables and also appearing at the main terminal, are numbered from one up and designated either *DF* for direct feeder or *F* for bridged feeder pairs.

All pairs in the house cable system that terminate at the main terminal without being directly connected or bridged to the central office cables are numbered as a separate group from one up and are designated *H* for house pairs.

Eleven Story Store and Office Building.—This building is chosen as an example of a complete conduit installation. Figure 7 is a plan of one of the office floors and Fig. 8 shows elevations of the conduit system and the cable system. The diameters of the conduits are indicated in order to show how the conduits decrease in size with the cables as they rise up through the building.

Owing to the lower portion of this building being arranged for stores, the office distribution on certain of the riser cables does not begin until the sixth floor is reached. *(To be continued.)*

Specifications for Galvanizing

Standard Tests

THE following specifications give in detail the tests to be applied to galvanized material. All specimens should be capable of withstanding these tests.

A. *Coating.*—The galvanizing shall consist of a continuous coating of pure zinc of uniform thickness, and so applied that it adheres firmly to the surface of the iron or steel. The finished product shall be smooth.

B. *Cleaning.*—The samples shall be cleaned before testing, first with carbons, benzine or turpentine, and cotton waste (not with a brush), and then thoroughly rinsed in clean water and wiped dry with clean cotton waste.

The samples shall be clean and dry before each immersion in the solution.

C. *Solution.*—The standard solution of copper sulphate shall consist of commercial copper sulphate crystals dissolved in cold water, about in the proportion of 36 parts, by weight, of crystals to 100 parts, by weight, of water. The solution shall be neutralized by the addition of an excess of chemically pure cupric oxide (CuO). The presence of an excess of cupric oxide will be shown by the sediment of this reagent at the bottom of the containing vessel.

The neutralized solution shall be filtered before using by passing through filter paper. The filtered solution shall have a specific gravity of 1.186 at 65 degrees F. (reading the scale at the level of the solution) at the beginning of each test. In case the filtered solution is high in specific gravity, clean water shall be added to reduce the specific gravity to 1.186 at 65 degrees F. In case the filtered solution is low in specific gravity, filtered solution of a higher specific gravity shall be added to make the specific gravity 1.186 at 65 degrees F.

As soon as the stronger solution is taken from the vessel containing the unfiltered neutralized stock solution, additional crystals and water must be added to the stock solution. An excess of cupric oxide shall always be kept in the unfiltered stock solution.

D. *Quantity of Solution.*—Wire samples shall be tested in a glass jar of at least two inches inside diameter. The jar without the wire samples shall be filled with standard solution to a depth of at least four inches. Hardware samples shall be tested in a glass or earthenware jar containing at least one-half pint of standard solution for each hardware sample.

Solution shall be used for not more than one series of immersions.

E. *Samples.*—Not more than seven wires shall be simultaneously immersed, and not more than one sample of galvanized material other than wire shall be immersed in the specified quantity of solution.

The samples shall not be grouped or twisted together, but shall be well separated so as to permit the action of the solution to be uniform upon all immersed portions of the samples.

F. *Test.*—Clean and dry samples shall be immersed in the required quantity of standard solution in accordance with the following cycle of immersions:

The temperature of the solution shall be maintained between 62 and 68 degrees F. at all times during the following test:

First—Immerse for one minute, wash and wipe dry.

Second—Immerse for one minute, wash and wipe dry.

Third—Immerse for one minute, wash and wipe dry.

Fourth—Immerse for one minute, wash and wipe dry.

After each immersion the samples shall be immediately washed in clean water having a temperature

between 62 and 68 degrees F. and wiped with cotton waste.

In the case of No. 14 galvanized iron or steel wire, the time of the fourth immersion shall be reduced to one-half minute.

G. *Rejection.*—If after the test described in section "F" there should be a bright metallic copper deposit upon the samples, the lot represented by the samples shall be rejected.

Copper deposits on zinc or within one inch of the cut end shall not be considered causes for rejection.

In case of a failure of only one wire in a group of seven wires immersed together or if there is a reasonable doubt as to the copper deposit, two check tests shall be made on those seven wires and the lot reported in accordance with the majority of the sets of tests.

The equipment necessary for the test herein outlined is as follows:

Commercially pure copper sulphate crystals.
Chemically pure cupric oxide (CuO).
Running water.
Warm water on ice as per needs.
Carbona, benzine or turpentine.
Glass jars at least 2 inches inside diameter by at least 4½ inches high.
Glass or earthenware jars for hardware samples.
Vessel for washing samples.
Tray for holding jars of stock solution.
Jars, bottles and porcelain basket for stock solution.
Cotton waste.
Hydrometer cylinder 3 inches diameter by 15 inches high.
Thermometer with large Fahrenheit scale correct at 62 and 68 degrees.
Hydrometer correct at 1.186 at 65 degrees F.
Filter paper.

Dielectrics at Telephonic Frequencies

By J. A. Fleming and G. B. Dyke *

Gutta-Percha.—It has long been known to telephonic engineers that a gutta-percha insulated cable possesses an effective dielectric conductance for alalternating currents far greater than its direct-current conductance. It was the desire to explore this matter more completely that instigated the present research.

Our first experiments on gutta-percha were made with some thin sheet gutta-percha supplied to us by the India Rubber, Gutta Percha & Telegraph Company. This was made up with tinfoil into a plate condensed of our standard size. The epitomized results are recorded graphically in Figs. 15 and 16.

The power factor varies with the temperature, but has a maximum value near 15°C. (see Fig. 16), at or about which temperature it is nearly the same for each value of the frequentcy we have used. These power-factor curves for gutta-percha exhibit a quality the reverse of the similar curves for vulcanized indiarubber in that they are convex upwards instead of downwards. Accordingly rather above 20°C. the temperature coefficient of the power factor is negative, but below that temperature it is positive. The fact that the temperature coefficient for the energy loss in a gutta-percha insulated cable at a frequency of 50 p. p. s. is negative above 10°C. was mentioned by Mr. Rayner in the discusison on Major O'Meara's paper.† The same quantity was also found to be negative by Mr. Campbell at a frequency of 800 p. p. s.

It is a very extraordinary thing that the power factor for the whole range of telephonic frequency should have a minimum value in the case of vulcanized indiarubber and a maximum value in the case of gutta-percha at or about normal atmospheric temperature.

We have since tested vulcanized India rubber, celluloid and gutta-percha at lower temperatures in carbonic acid snow and liquid air, and found that vulcanized rubber has a maximum value for its power factor at —20°C., celluloid at a still lower temperature and gutta-percha at +15°C. Figs. 16 and 17 illustrate these results.

We then conducted some tests on ordinary gutta-percha insulated cables. Two samples were prepared for us by the India Rubber Company, one consisting of a sigle pair of gutta-percha covered copper wires packed up with impregnated hemp to complete the

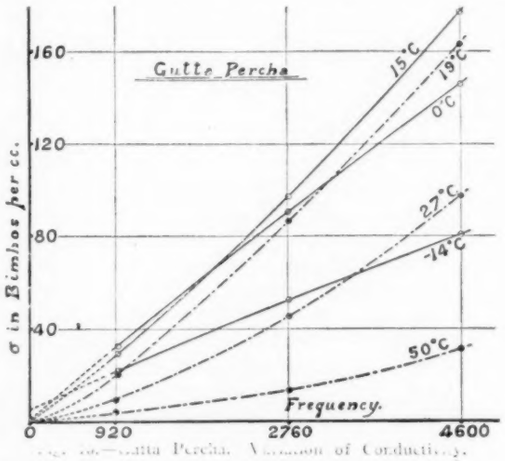


Fig. 16.—Gutta Percha. Variation of Conductivity.

space and then braided over to make a cable. The other sample was a twin-wire cable, and consisted of a pair of similar copper wires, but both embedded in the same gutta-percha covering, the centers of the wires being 0.24 cm. apart. The copper wires were in both cases No. 18 S. W. G. size and 1.22 mm. or 0.048 in. in diameter.

The first result noticed was the degree to which the power factor of the single-pair cable exceeds that of the twin-wire cable, being nearly four times greater. A little consideration showed, however, that

*Concluded from September.
†W. A. J. O'Meara, "Journal of the Institution of Electrical Engineers," Vo. XLVI., p. 412, 1911.

this is only what might be expected from the nature of the path of the lines of electric strain between conductor and conductor. In the case of the twin-wire cable this path is almost wholly in the gutta-percha insulator, and in the other case partly through gutta-percha and partly through impregnated damp hemp with air spaces between. Hence, for telephone cables we see the importance of embedding both lead and return wires in the same gutta-percha covering, and not using ordinary undried impregnated hemp as packing between separate gutta-percha insulated wires merely laid together.

Having regard to the influence of S/C upon the attenuation constant it is certainly unfortunate that gutta-percha, which is unique in its qualities as a

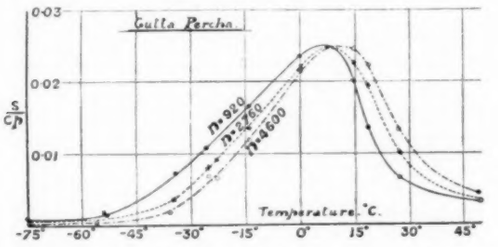


Fig. 16.—Gutta Percha. Variation of Power Factor with Temperature.

cable insulator, should be unique also in possessing a large maximum value for its alternate-current dielectric conductivity at or about ordinary temperatures. If vulcanized india-rubber could be used instead it would, in this respect, have great advantages. If any way could be found of employing dry paper as the effective dielectric for submarine cables there is no question that a great improvement in transmission qualities for telegraphy and telephony would result.

Slate, sulphur and mica were also tested. In the case of undried slate the power factor is almost always greater or much greater than for the well-dried slate.

SUMMARIZED RESULTS.

Some of the results for the various dielectrics tested are collected in the accompanying table. Owing to the large number of figures of observation we shall only take those values which refer to observations made at normal atmospheric temperature. For the three frequencies used we have calculated the approximate dielectric constant and resistivity in megohms per centimeter cube of the various dielectrics, and also the alternating resistivity per centimeter cube.

It will be seen that the alternating current dielectric constants of the crown glass, celluloid, dry Manilla paper, paraffin, ebonite and mica are quite of the same order as the values obtained with steady electric force. On the other hand, the values for India rubber, pure and vulcanized, and for gutta-percha, are rather lower than the values obtained with undirectional electric force.

The general agreement of the dielectric constants obtained by our method for alternating electric force of telephonic frequency with the values obtained by other methods is a fair proof that the measurements made by us are substantially accurate. It must be remembered, however, that with soft dielectrics, such as india-rubber, it is very difficult to be certain of the precise thickness, and also of the real effective cross-section of the dielectric. The figures bring out, however, certain interesting results. They show, for instance, that gutta-percha has an abnormally low alternating-current dielectric resistivity, or large conductivity, and that it has abnormally large values for the ratio S/C when compared with vulcanized india-rubber. The power factor of vulcanized india-rubber at ordinary temperatures is only one-tenth that of gutta-percha, and its alternating current resistivity is ten times as great, and therefore its ratio S/C is ten times smaller at ordinary temperatures, say 16-20°C. These measurements show, also, that the value obtained for the so-called dielectric resistance of insulators by measuring the current which flows through them after applying for one minute a steady volage has very little relation to the true alternating-current resistivity, with which alone we are concerned in telephony.

This latter number, as obtained and measured by us, is the real index of the energy dissipation in the dielectrics. For the total alternating-current resistivity reckoned in megohms is the number which must be divided into the squares of the P. D. of the two conducting surfaces of the cable or condenser to obtain the power absorption in microwatts. The so-called dielectric resistance of such bodies as glass, ebonite, gutta-percha, as measured after one minute's electrification in the usual way with a steady voltage, is a number reckoned in thousands or millions of megohms.

Thus the handbooks give as the dielectric resistance of gutta-percha as used on cables 3.5×10^8 megohms per centimeter cube at 75°F., and for pure indiarubber 18×10^9 megohms per centimeter cube at

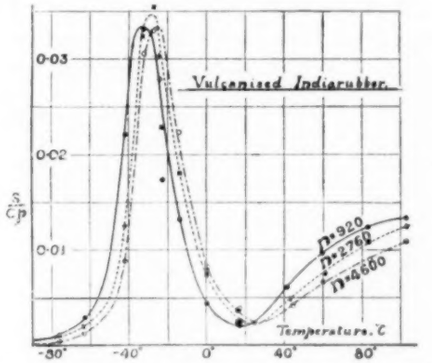


Fig. 17.—Vulcanized Rubber. Variation of Power Factor with Temperature.

15°C., both after one minute's electrification. But these numbers are nearly 100,000 times greater than the true alternating-current resistivity for the telephonic standard frequency of 800 ~.

In the same manner the direct-current dielectric constant of india-rubber is given in the books as varying between 3.0 and 5.5, and that of gutta-percha from 3.5 to 7.0 when tests are made with india-rubber insulated or gutta-percha insulated cables. These direct-current values are, however, quite inapplicable in telephonic calculations. In these latter the true values are those as obtained by us.

In a further table the authors summarize certain data from the previous tables, including for each dielectric the value of the specific conductance per cen-

timeter cube (σ) in bi-mhos ($=10^{-12}$ mho) for normal temperatures.

CONCLUSIONS.

The following are the conclusions arrived at as a result of the measurements above described:

1. All the dielectrics so far tested prove to possess a true dielectric conductivity for alternating currents considerably greater than for steady unidirectional currents.

2. This increased conductivity implies greater power dissipation for the same terminal P. D. or voltage.

3. The alternating-current conductivity increases with the temperature, except in the case of vulcanized indiarubber rather below 20°C., and gutta-percha rather above 15°C., in both of which cases it decreases with rise of temperature. In the case of mica and very dry paper it is not affected to any sensible extent by rise of temperature over a range between 0°C. and 60°C.

4. The alternating-current conductivity is in most cases a linear function of the frequency, and may be expressed in the form $\sigma=a+bn$, where a and b are coefficients, which are functions of the temperature, and n is the frequency.

5. The alternating-current conductivity, especially that part of it denoted by a, is greatly increased by the presence of moisture in the dielectric. This part is probably identical with the true direct-current conductivity.

6. The part of the conductivity denoted by the coefficient a is possibly electrolytic in nature, whilst the part proportional to the frequency is a consequence of an energy loss which is possibly analogous to the hysteresis loss in iron.

7. The dielectric constant for alternating electric force is in most dielectrics rather smaller than that for steady or unidirectional electric force. In no case is it larger.

8. In the case of pure indiarubber and vulcanized india-rubber the temperature coefficient of the dielectric constant may perhaps be negative within the range of telephonic frequencies, and 0°C. to 50°C., but this result is not quite certain.

9. The ratio $S/C\rho$, nearly identical with the power factor, is, for some dielectrics, such as mica and dry paper, a constant independent of frequency and temperature. For most dielectrics it increases with rise of temperature but decreases with rise of frequency. The power factor variation with temperature of vulcanized india-rubber and gutta-percha is quite abnormal.

10. Those dielectrics, such as celluloid and gutta-percha, which have large alternating current conductivity, although free as far as possible from moisture, also exhibit in a marked manner the phenomena of dielectric absorption and residual charge.

11. For certain dielectrics there is a temperature at which the power factor and alternating conductivity have maximum values.

The Swedes are thinking of laying a telephone cable from Marieholm near Stockholm to Abo across the Finnish Bay. The Norwegians are very interested in this proposition as they could also communicate with Finland by telephone. It remains to be seen what the Russian authorities will say to this. The cost is estimated at one half million Finnish marks.

New York Commission News

As a result of an inspection made by the Wyoming County Telephone Company's exchange at Castile by an inspector from the New York Public Service Commission, second district, the telephone company has advised the commission that it is now giving continuous service, that it has added another operator to its force, and will make a number of improvements to its plant with a view to improving the service as recommended in the inspector's report.

The Metropolitan Telephone and Telegraph Company, of Albany, has made a complaint to the commission against the New York Telephone Company because the latter has refused to furnish telephone service to the complainant.

The Federal Telegraph and Telephone Company, which owns the control of the Rochester Telephone Company, has been ordered to show cause before the commission at Albany why an action in the supreme court to recover the penalties provided in cases of violation of the public service law should not be brought.

It is alleged that the telephone company is unlawfully giving free service to thirty patrons at Mt. Morris, six at Batavia, twelve at Avon, ten at Dansville, eight at Geneseo, eleven at Bath and two at Warsaw.

The Commission has been notified that the New York Telephone Company has acquired the physical property and business of the Citizens Standard Telephone Company operating in Kingston, Rosendale, Shokan and vicinity in the sum of $152,700. The consent of the commission was not necessary to the change in ownership of this property.

The Postal Telegraph Cable Company has advised the commission that it will show in the tariff book that messages sent to the telephone subscribers in Port Dickinson, N. Y., will be delivered free of charge by telephone from the Binghamton office.

Telephone Girls Entertain Mothers

The Iowa Telephone Company operators of Des Moines were "at home" one recent afternoon to their mothers. It was the first entertainment of the kind attempted by the young women, but they are planning to keep open house once each month. The object of the reception, aside from the social side, was to give the mothers of the girls a chance to see under what conditions the operators are working. Every courtesy was extended their guests by the young women who talk to thousands of persons each day. The main room on the third floor of the building proved the most novel sight shown the visitors. Here the mothers had the chance to see the girls working at the switchboards and attendants explained the system in detail to the uninitiated.

New York Directory Increase Great

The new issue of the New York Classified Telephone Directory has been distributed in Manhattan and the Bronx. This year thirteen carloads of these books taxed the energy of the delivery force of one hundred men from the Battery to 200th street, this being an increase of more than 60 per cent in the distribution of last year, when a record was made with eight carloads.

Nebraska Commission News

The Nebraska Railway Commission has given permission to the Cheney Telephone Company to issue $1,500 of stock. The vote of the commission was unanimous, the second time it has been so on such a question since Commissioner Hall has been a member. The telephone company is a mutual affair. Its officers asked leave to issue $275 of new stock for construction and asked the commission to approve a former issue of $1,225 which had been issued without the commission's authority. The officers explained that when this stock was issued they did not know the law required the approval of the stock. The total of all stock issued is $1,500. The railway commission's physical valuation department has valued the plant of the company at $1,700.

The Lincoln Telephone & Telegraph Company has filed with the state railway commission records showing long distance rates to all exchanges in the state. The list comprises several books and is the first rate record filed since the local company took over the plants of the Bell Telephone Company in South Platte territory.

The Cuming County Independent Telephone Company, which has been charging a flat rate of $15 a year for business and residence telephones at Beemer and Wisner, has been given permission by the railway commission to establish rates as follows: Business, individual line, $30; business, two-party and residence individual, $24; residence, two-party, $21; residence, four-party and farm line, $18.

Permission has been given the Lincoln Telephone & Telegraph Company to discontinue its exchange at Friend. The local business has all been taken over by the Saline County Telephone Company, and the Lincoln company now confines itself to the long distance field. The free service which it gave to Cordova and Exeter is cut off by this arrangement.

Maryland Commission News

A complaint has been registered with the Maryland Commission by W. E. Robinson & Company, of Belair, against the practice of the telephone company of overloading party lines in the rural districts. There are so many connections, it is claimed, that subscribers are frequently unable to get a number.

The Chesapeake & Potomac Telephone Company has filed an answer with the Maryland Public Service Company opposing the extension of contracts for flat-rate telephones in the business district of Baltimore.

The Protective Telephone Association of Baltimore stated in its petition to the commission that it was making an investigation of the prevailing rates for business service in all of the large cities of the country, and that the inquiry had gone far enough to show not only that Baltimore rates for measured service are excessive but that the large majority of important municipalities have a flat-rate business service. The reply of the company, made through its attorneys, states in substance that the petition if granted would practically re-open the whole question of telephone rates which was decided by the commission in its opinion of April 25 last and which established the present rates. That the commission has ruled on the very points made by the association is pointed out, and the company claims that the whole matter of rates is now properly settled. It furthermore claims that to allow another hearing would be to bring out nothing which has not already been brought out. The association contends that the telephone company could furnish a flat-rate service in the business district of Baltimore at a reasonable profit for less than $100 annually.

Oklahoma Commission News

The Oklahoma Corporation commission expects numerous petitions to be filed asking it to lower telephone rates in Oklahoma City, as well as in other towns, since the Supreme Court's decision holding that municipalities could not fix the charges. According to the Pioneer Telephone and Telegraph Company involved in a recent case, patrons at Oklahoma City are not entitled to collect a rebate, notwithstanding the advance the company made in rates, and the attempted agreement supporting the increase on the city's part were illegal. The commission fined the company $100 for advancing its rates without securing the commission's consent. The decision settled beyond question that only the commission could fix telephone rates, such authority extending to towns in both of the old territories, Indian Territory status having been determined in the McAlester-Eufaula case. There is something like $60,000 coming to subscribers in Oklahoma City, James Twyford, the former city attorney, says, and proceedings will be instituted to recover it.

Washington Commission News

A petition signed by 100 citizens of Castle Rock, urging the consolidation of the two telephone companies operating in Olympia, Wash., has been filed with the Washington State Public Service Commission. Complaint is made on the ground of poor service.

The public service commission entered an order directing that subscribers of the Olympia farmers' line be allowed telephone connections with the Olympia Telephone Company or Bell system for $5 a year, this being a cut from $7.20, as fixed by the company. Formerly the subscribers of the rural lines in Olympia were connected with Olympia at a rate of $3.60 a year. The Bell company raised the rate to $7.20 and a complaint was filed. The Pacific Telephone Company is expected to fight the order. If no litigation is started it will perhaps cause a readjustment of rural telephone rates in all sections of the state.

Ohio Commission News

The Adams County Telephone Company applied to the Ohio Public Service Commission for authority to sell its entire plant to the Manchester Telephone Company. Both plants are in Manchester. The purchase price is $494.94. The Adams company has forty-five subscribers.

Permission to purchase the Adams County Telephone Company has been granted the Manchester Telephone Company by the utilities commission. The companies have been competitors for five years, and the sale, which involves the 45 subscribers of the Adams Company, will give the purchaser control of the field.

Envy American Telephone System

Three engineering officials of the German Post Office Department at Berlin are about to sail for the United States in order to investigate American telephone systems. They will be gone five weeks, and will visit New York, Philadelphia, Boston, St. Louis, Chicago and Columbus.

The trip is undertaken with a view to introducing radical and much-needed reforms in the antiquated German telephone system. Telephones are cheap in Germany, but have few other virtues. The average office and house telephone in the biggest cities costs $50 a year, and long-distance messages, regardless of mileage, cost 25 cents apiece between any points for three minutes.

In other respects the service is abominable. Telephoning after 10 o'clock at night in cities costs 5 cents extra per conversation, and connections are possible only after a delay of three to five minutes, owing to the reduction of the daytime staff by about 75 per cent.

American telephones are regarded in Germany as the best in the world, and the hopes and prayers of business men and householders accompany the Post Office Department's commissioners to America.

The postal authorities of Germany have decided to copy the Swedish example and to install automatic telephones in some of the busiest and noisest thoroughfares of Berlin, with a view of testing it under the worst conditions. Should the results be satisfactory, automatic telephones will be installed throughout the city.

Cleveland Wants Control of Company

Cleveland city officials threaten to run a race with the Cleveland Telephone Company to gain control of the Cuyahoga Telephone Company.

The city cannot avail itself of the municipal ownership amendment until after November 15, however, and, in the meantime, the Cleveland Telephone Company is expected to make application to the state utility commission for permission to take over the independent company.

Mayor Baker favors a city-owned telephone company. He is said to be backing an ordinance to buy the Cuyahoga company.

Merger plans of the two companies have been in process of formation several months, and the Bell people hope to outdistance the city in the race. Already the Cleveland Bell Company has filed a statement of its assets and liabilities with the commission.

It is generally understood that J. P. Morgan and company, principal stock owners of the Cuyahoga company, would welcome an opportunity to dispose of its holding to the city or the Bell people.

Arrange for San Francisco Congress

The committee on organization of the International Electric Congress, which will be held in San Francisco during September, 1915, has arranged tentatively the following list of sections:

(1) Lighting and illumination, including electric lighting of all kinds, electric radiation, etc.; (2) generation, transmission and distribution, including hydroelectric plants, steam stations, transformers, substations, etc.; (3) electric traction and transportation, including propulsion and electric vehicles; (4) electric power, including the application of electric motors to industrial purposes; (5) economics, including load-factors, power-factors and all problems affecting the economy of electric distribution, also regulation by public service commissions, etc.; (6) machinery, transformers and appliances; (7) telegraphy and telephony, including all communication and signaling by wires; (8) wireless telegraphy and telephony, including all communication by electromagnetic waves without wires; (9) electrochemistry and electrometallurgy, including electric furnaces; (10) electric measurements and instruments; (11) protective devices and transient and high-voltage phenomena; (12) miscellaneous.

Denver Indorses Proposed Bill

A proposed bill for a telephone ordinance calling for a reduction in the present telephone rates in Denver and requiring any telephone company operating in the city to pay for the use of the streets and alleys and to conduct its business according to the terms of a revocable permit, to be granted by the city, was indorsed by the Denver Business Men's Association, the Chamber of Commerce, the Real Estate Exchange and the Retail Association at a joint luncheon in the Albany Hotel.

The proposed ordinance calls for a flat rate of $7 per month for business telephones, and for other reductions in rates for both unlimited and measured service.

The indorsement of the measure was strongly opposed by Supervisor Henry Walker, Edward P. Costigan, D. C. Burns, W. P. Daniels and others, on the ground that sufficient opportunity had not been given them to study the proposed bill thoroughly enough to vote upon it intelligently.

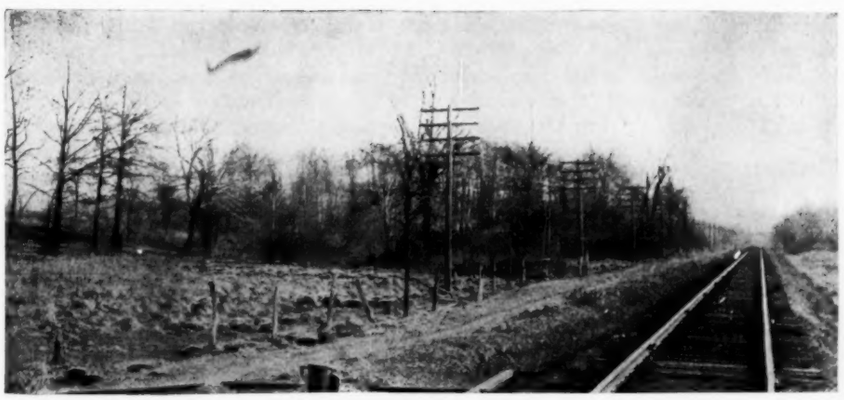
Attorney James H. Brown pointed out that the principal purpose of the proposed measure is to enable the city to ascertain the physical valuation of the Denver properties of the Mountain States Telephone and Telegraph Company.

"The ordinance would be only a temporary measure, anyway," said Attorney Brown, "and changes could be made later."

Describes Telephone Time Saver

The following description of a "telephone time-saver," which was invented by H. Waymouth Prance, is that of the London *Times*:

The "telephone time-saver" consists of a sound-magnifying trumpet, of flattened form similar to certain types of motor horns, behind which is a platform adapted to support the telephone receiver. On receiving or making a call and being asked to "hold the line a moment," the user, instead of "holding on" with the receiver pressed to his ear, merely drops it upon the platform of the device, where it automatically slides into position with the earpiece against the small end of the trumpet. The user is then free to go on with his work until the voice from the trumpet shows him that the person at the other end is speaking, when conversation may be carried on by means of a loud speaking trumpet, or the receiver may be lifted off the instrument and used in the ordinary way. The device has met with some popularity.



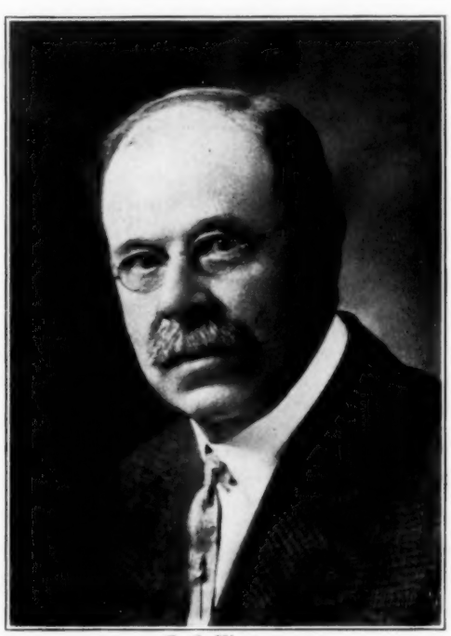
DEPARTMENT of RAILWAY TELEPHONES

From Night Operator to Superintendent

G. C. Kinsman, Wabash Railroad

YOU may have noticed by this time, if you have been reading this Index to the Hall of Fame, that most of these railroad officials enter the game while in their 'teens. The college graduate, who gets to work somewhere around an age of twenty-five, has never been at a premium in railroad work. The railroad is a jealous mistress. She insists that the period of adolescence be spent in absorbing nothing but railroad knowledge. The natural result is that later years can offer no sufficient inducement to change. Once a railroad man always a railroad man—or nearly always.

In this respect superintendents of telegraph are true to form. Cheney entered the service at thirteen years. Caskey was but fourteen. Johnson was nearly nineteen. And the subject of our present literary effort was just eighteen when he cast his lot with the Wabash Railroad. For the time was August, 1868; and G. C. Kinsman was born August 22, 1850. The place was Ellington, New York, in Chautauqua county. Ellington is one of those places that appear on the map in minute italic letters, and are not listed under "principal towns and villages." It is midway down the eastern edge of the county, located beside a small creek that feeds Chautauqua Lake, but about three miles from the nearest railroad—a branch of the Pennsylvania. Have you noticed, by the way, how many of these people come from little villages and country places? Maybe that has something to do with their success. Kinsman, however, had additional qualifications in the shape of ancestors. Those paternal came from North Hampshire, England; the maternal division from Amsterdam, Holland. Great combination for sticktoitiveness.



G. C. Kinsman.

Anyway, young Kinsman entered the service of the Wabash at Napoleon, Ohio, in 1868, as night operator—the usual opening move of the game. That was in August. One month later he was transferred to Rockfield, Ind., as agent and operator. Quick work right from the jump, you see. In 1870 he became an operator in the dispatcher's office at Lafayette, Ind. Then he was transferred, in 1871, to a clerkship in the division superintendent's office in Lafayette. Bent on trying all the branches of railroad work, he went on as extra freight and passenger conductor during 1872. From January to May, 1873, he was car service agent. From that he jumped to train dispatcher at Springfield, Ill.—which office is on the way toward the superintendency of telegraphs. He dispatched trains until March, 1878.

Just here occurs the only break in G. C. Kinsman's railroad record. He resigned to enter the United States postal service. But it was no use. He couldn't keep away from the railroad game. In a year he was back in it as chief train dispatch-

Department of Railway Telephones

This department is established as a permanent feature of TELEPHONE ENGINEER. The progress of the art of telephone train dispatching, its technical development, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of TELEPHONE ENGINEER in all parts of the world whose interests lie along these lines.

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er for the Wabash Railroad at Springfield. In August, 1881, he was appointed assistant superintendent of telegraph, and in July, 1884, became superintendent of telegraph. There he still is, at Decatur, Ill., handling something over two thousand miles of track circuit. He is an active member of the Association of Railway Telegraph Superintendents.

More Telephones for Central of Georgia

The Central of Georgia has recently ordered from the Western Electric Company, the necessary apparatus for making the third installation of telephone train dispatching equipment within the year. The first section of road to be so equipped extended from Columbus, Georgia to Birmingham, Alabama, and the second from Macon to Atlanta, Georgia.

For the third installation, practically the same type of equipment as that used on the other two will be furnished. The section of road to be equipped will extend from Macon to Columbus branching off at Fort Valley and going from there to Albany, Georgia, a total distance of approximately 180 miles. The dispatcher will be located at Albany. This leaves only one section of the main line not equipped for telephone train dispatching—the division from Savannah to Macon—but plans are already being made for this installation.

Seventeen way-stations will be equipped with Western Electric No. 102-B selector sets containing the well-known No. 50 type selector. Seventeen siding telephones of the No. 1317-W type will be installed in booths to be built along the right-of-way and every train operated on the division will carry a No. 1330-E portable telephone set which may be connected to the line at any point in case of emergency, thus putting the conductor in touch immediately with headquarters.

The wire and hardware for the pole line are also to be furnished by the Western Electric.

More Telephones on the Northern Pacific

The Northern Pacific is continuing to extend its telephone train dispatching circuits. To this end, an order for the necessary equipment has been placed with the Western Electric Company. The present equipment is to be used in equipping the Wilton branch which covers the territory lying between Jamestown and Wilton, North Dakota. This stretch of road is approximately 115 miles in length. The dispatcher will be located at Jamestown.

Six way-stations will be equipped along the right-of-way. The type of apparatus to be used in the telephone train dispatching circuits is the No. 101-B selector set, containing the standard Western Electric No. 50 type selector.

Telephones on the Wabash Railroad

The Wabash Railroad has recently ordered apparatus to equip two of its divisions with telephones for train dispatching. The Western Electric Company, which is furnishing the equipment, is also furnishing the miscellaneous supplies to be used in running the circuit wires.

One division to be equipped extends over a distance of approximately 115 miles from Decatur, Ill., to St. Louis, Mo., the dispatcher being located at Decatur. On this line there will be thirty way stations equipped with No. 102-B selector sets, containing the standard Western Electric No. 50 type selector. Three other sets will be held in reserve. The other division will cover a distance of about 75 miles, from Decatur to Danville, Ill., with the dispatcher also at Decatur. Seventeen way stations will have No. 102-B selector sets, with three others held as spares.

The telephone sets will be of the long swinging arm type with head receiver—the No. 1020—and a key board for the total of 53 stations will be located at the dispatcher's office.

Telephones on the Northern Ontario

One of the latest of the Canadian railroads to join the ranks of those using the telephone for train dispatching is the Temiskaming and Northern Ontario operating in the Province of Ontario. With this end in view, an order for the necessary equipment has been placed with the Western Electric Company, which has furnished similar apparatus for other roads in the dominion.

The main line of the road from North Bay to Cochrane and the Porcupine Branch extending from Timmins to Iroquois Falls Junction will be equipped—a total distance of approximately 290 miles. The train dispatcher will be located at North Bay.

Twenty-seven way stations in all will be equipped with No. 102-B selector sets, containing the standard Western Electric No. 50 type selector. Four spare selector sets will be held in readiness for emergencies.

Great Northern Extending its Telephones

The continued success of its telephone train dispatching system has prompted the Great Northern Railway to install telephones for this purpose over a new section of road. The necessary apparatus for this installation is being furnished by the Western Electric Company, which also furnished equipment in use on other portions of the lines.

The new section of road will operate between Fargo, North Dakota and Minot, North Dakota, a distance of approximately 240 miles. The telephone circuit will cover the entire line. The dispatcher will be located at New Rockford, which is approximately the physical center of the division.

Twenty-five way stations will be equipped with relay type selector sets which make use of the standard Western Electric No. 50 type selector.

Telephone Lines Take Wireless Signals

The hourly signals sent out from the Eiffel Tower in Paris were received at Nancy upon an ordinary telephone line connected up for conversation. This statement was made by M. E. Leimer in a communication to the French Physical Society at a recent meeting.

This line is partly overhead and partly underground, and the signals were received quite as clearly as upon an ordinary wireless receiving apparatus. The telephone line has a length of 4,500 meters overhead and terminates at the exchange in an underground section 1,000 meters long. This line was connected to another, which has an overhead length of 210 meters and an underground section 500 meters long.

Maintenance of Telegraph Lines

By G. M. Yorke*

A TELEGRAPHIC company must have a good plant—not merely a plant which is good under favorable conditions, but one which may be worked with ease and speed in wet weather, which will not go out of business because of lightning or foreign currents, except when the conditions have for the moment become too hazardous to be endured, which will stand firm through heavy gales, and which is as far as practicable free from the menace of falling trees and from liability to serious interruption by sleet storms. Little annoying things must not be always happening to it. All this is necessary to give reliable service, which is a duty as well as a source of profit.

The careful initial construction required to obtain such a plant is well understood. What I wish to call attention to are the steps to be taken to ensure steady reliability as the plant grows old. Whether the plant is watched and kept up in a far-sighted manner, or is treated with indifference, with a view chiefly to the ease and economy of the moment, makes a great difference in the service to be obtained from it.

Taking particularly the outside plant, the results that ought to follow from good original construction may gradually be vitiated by inadequate regular attention to the inevitable small recurring sources of trouble, such as leaning poles, loose ties, and loose or broken insulators; by alterations in construction, such as the insertion of cable; by unheeded changes in surrounding conditions, such as the construction, dangerously near, of high tension lines, the erection of buildings, and the washing out of embankments; and by lack of systematic replacements of decayed, rusted or worn-out parts.

To correct at an early stage the numerous defects which a telegraph line is constantly tending to develop, requires a close and intelligent personal interest. The most effective way of securing this that I know of is to combine a proper supervisory system, including means for comparing results, with the plan of dividing the lines up into suitable sections, say a hundred miles, more or less, according to conditions, giving a lineman complete control, under proper supervision, of the routine repairs to each section. The lineman should make regular inspection trips over his section, on which he should repair minor defects before they cause trouble and interruption to service. He should do all maintenance work which can economically be handled by himself and not more than two assistants. In general, he should clear the trouble on his section, but if some other lineman should be more available for a given trouble, that lineman should be assigned.

Under this plan the lineman is under the direction of the wire chief when clearing trouble. At all times the wire chief knows the lineman's whereabouts. The wire chief, however, is not the judge of the physical quality of the lineman's work. This is a matter for the inspection and the criticism of line inspectors, line supervisors and plant chiefs.

Heavy maintenance work, such as extensive pole replacements, or changes in location, or the repairing of general breaks, should, of course, be done by regular gangs.

A principal penalty for not paying enough attention to the prompt correction of small defects is an unnecessarily large number of what are very significantly known as "troubles." If we can establish a system which makes an increase or decrease in the number of troubles in a given section of line conspicuous, which makes comparison unavoidable between one section and another, and which makes this exhibit not only to the superiors, but also to the men who actually do the work and know that they are responsible for the results, and who see every time they clear a trouble the relation between cause and effect, we will be taking an important step in the direction of keeping the number of troubles down to a reasonable minimum.

This is the object of the system now being put into effect by the telegraph company for "counting, recording and reporting line troubles."

A system of reports to be effective should give the following information and data:

1. Speed in clearing line troubles, together with the nature and cause of such troubles.

2. Nature and locations of line troubles as determined by the wire chiefs compared with the causes and actual locations of the troubles as found by the section linemen.

3. Data which will fix the responsibility for excessive delays in clearing line troubles and any unnecessary expense connected therewith.

4. Data which will associate the troubles on a given section of line with the last inspection of that section, in order to determine if inspections by the section linemen are too infrequent or not thorough.

5. Data from which a detail monthly analysis of line and cable troubles and their causes can be made, by sections of line and by districts, and which will give a basis on which to compare the efficiency of the districts and direct future repair work.

6. Data from which the troubles per mile of wire and the average time to clear a trouble can be determined. Based on the troubles per mile of wire and the average time to clear a trouble, it will be possible to establish a friendly rivalry between districts and between section linemen by issuing a monthly statement showing the rating of the various districts in the division and the rating of the section linemen in a district or in the division.

A system of reports which will provide for all the above is described in the engineering department instructions. These instructions describe a method of counting, recording and reporting line troubles and the forms to be used in such work.

The instructions provide for putting the comparative results in the hands of the linemen and of the various responsible officials. The comparisons the lineman receives are between himself and other linemen. District superintendents receive comparisons between themselves and other district superintendents. The final summary, by divisions, is made up in the general office. Any extraordinary change in the results shown by these final sum-

*Paper read at annual convention of Association of Railway Telegraph Superintendents, New York.

maries can be readily traced back in the manner customary with such systems to the individual linemen's sections.

A high degree of efficiency in clearing troubles on line wires requires close co-operation between the wire chiefs and the section linemen. The test rooms are rapidly being equipped with suitable apparatus for testing and locating troubles in line wires, and as the wire chiefs become familiar with the use and handling of this testing apparatus, locations of troubles on line wires should be made more rapidly and more accurately than at present. The quicker and more accurately a line trouble is located by the wire chief, the quicker it will be found and cleared by the section lineman. Accuracy on the part of the wire chiefs and co-operation between the wire chiefs and the section linemen is essential for the prompt and efficient clearance of troubles. It is believed that the system of reports covered by these instructions is such that the efficiency of wire chiefs and section linemen can be readily determined and improved work on the part of either of such class of employes easily seen.

The reports provided for will be of great value in determining the necessity for the renewal of iron wires. When troubles per mile of wire on iron wires equal the troubles per mile of wire on copper wires, it indicates that the iron wires are approaching a condition requiring replacment. Troubles per mile of wire on No. 9 B. & S. gauge copper wires should be the standard by which to judge iron wires and when the condition of iron wires becomes such that the number of troubles per mile of wire exceeds those on copper wires, the iron wires should be renewed.

As a result of the routine maintenance, and trouble analysis systems described, very great improvement, over overage conditions, in the reliability of the wires may confidently be expected. I will not attempt to say just what percentage improvement will be found, but I know that as a result of such methods one telephone company doing a large toll line business, while doubling its wire mileage in eight years, and working all the time under practically the same construction specifications, made a steady reduction in the total number of line troubles. At the end of the period the troubles per mile of wire were less than half what they were at the beginning.

The rivalry developed among the linemen has been a very real factor in bringing about these results. The men take a keen interest in the elimination of any hazard which may impair their record, and in making sure that whenever they do anything they do it so that it will stay.

An influence that has in many cases decreased the speed or the reliability of the wires has been the tendency, when changes have had to be made in lines, to replace or piece out the specification construction with something not quite so good. The height of the wires may have been increased by splicing out an existing pole with something not nearly as strong as the pole itself—I have seen a crossarm used for this purpose. Every change of this kind leaves a weakness which may start a break or be the cause of a minor trouble.

The use of somewhat higher poles may have been avoided by the insertion of a length of rubber cable. While it is true that one piece, of average length, may not noticeably impair the working of the wires, yet the amount inserted in the aggregate has been sufficient to account for much of the difficulty that has been found in wet weather working.

The manner in which a necessary change should be made should be decided not from the standpoint of the case and economy of the moment, but with a realization of what the effect on the whole service is going to be if the solution accepted in the case under consideration should be made the standard method of meeting similar subsequent cases.

While more or less temporary work is unavoidable, a good rule is to do work of a temporary nature only to meet a temporary condition. If the condition to be met involves a permanent change which it is practicable to make at once, that change ought to be made in a permanently satisfactory manner.

One of the most serious changes we are finding in surrounding conditions is the erection of high tension lines alongside the railroad right-of-way. A power company, wishing to transmit power at high potential from one point to another, quite naturally finds, in many cases, not only that the railroad has the shortest and most feasible route between the two points, but that the right to set its poles or towers can be more easily and cheaply obtained close to the railroad right-of-way than at some distance away. Hence, unless something is done about it, the close paralleling of railroad rights-of-way by high tension lines is one of the things naturally to be expected.

In so far as this practice results, as it usually does, in the presence of a high tension line and a telegraph line nearer together than the height of the taller pole, the telegraph company objects strongly to it, and the railroad company, in my opinion, ought also to object. The telegraph company's position in this matter is as follows:

Except in special cases where it is impracticable to secure a location at a safe distance away, it is a violation of good practice to locate a high tension transmission line in close proximity to a telegraph line, irrespective of the grade of construction which may be employed in the high tension line. Where it becomes necessary to construct a high tension transmission line so that at certain points it comes into proximity with the commercial telegraph line, either through parallelism or through a crossing, good practice requires that extra precautions be taken in the construction of the high tension transmission line to minimize the liability of the high tension transmission wires coming into contact with the telegraph wres by reason of accidental conditions.

The special conditions which are generally accepted by the best engineers as necessary in order to safeguard the exposure so far as is reasonably practicable where the exposures are necessary, are contained in the high tension crossing specifications of the National Electric Light Association endorsed and accepted by your association, by the American Institute of Electrical Engineers, American Electric Railway Association, American Railway Engineering and Maintenance-of-Way Association, etc. These specifications prescribe such margins of mechanical and electrical strength for the high tension structure as to reduce to a very low degree of probability the liability to a breakdown.

The reason why the telegraph company takes the position that a high tension transmission line or ordinary construction should never be built in close proximity to a telegraph line is that a needless hazard to life and property is thereby created.

The hazard is there because of the real liability to a great variety of accidents and failures to which any ordinary pole line is subject, and which may result in contact between a high-tension wire and a telegraph wire; and because of the serious and unpreventable nature of the results that may follow from such contact.

Some of the accidents to which the ordinary high-tension line is subject are as follows:

Breaking of a pole.

Uprooting of a pole.

Shattering of a pole by lightning.

Burning of pole, either from arcs or from external sources, such as fires due to sparks from locomotives.

Breaking or burning of crossarms.

Breaking or burning of insulator pin.

Failure of an insulator, either from mechanical forces, such as storms, shot, or the mechanical strain from the wire, or inherent defects, or by electrical strain, such as surges or lightning.

The burning of a transmission wire from a defective insulator, by lightning, or by contact with a piece of foreign wire, branches of trees, kites, etc.

The breaking of a line wire, due to a flaw or inherent defect in the material, nick, scar or defective joint, or by reason of the wire being overloaded from ice, sleet or snow, or by wind pressure in times of storms.

By the sagging of the transmission wire combined with swinging due to the force of the wind.

The breaking of line wires and the crossing of high tension and telegraph wires due to roofs of freight cars being blown off and falling on these wires.

Any of the above or similar accidents may result in imposing upon the telegraph wires the voltage and large power of the high-tension line. The impracticability of constructing the telegraph plant to withstand such voltages, in view of the multitude of wires and pieces of apparatus, the delicacy of the contacts, and the necessary fineness of the wires, is evident from the elaborate precautions taken in their own stations by the power companies themselves. There is no known protection system that affords any real safety against these voltages. Therefore, the presence, even momentarily, of these voltages in the telegraph plant, endangers, possibly over a wide area, the lives of employes and patrons, and is liable to disrupt the telegraph system and to cause fires at points near to and remote from the source of the trouble. The railroad company is very liable to suffer also.

As a high-tension line is merely a means of carrying power from a generating center to one or a few points usually at some distance, the precise route for it is from the power company's standpoint merely a matter of practicability, convenience and economy. If proper representations are made to the power companies, before their right-of-way is secured, of the telegraph company's position, they will often avoid building in locations unsatisfactory to us, and the controversy and litigation which result when the question is taken up after the power line is built in a location imperiling the telegraph property will be avoided. This is the important thing—to take action in the early stages of the power project.

A high-tension line paralleling a telegraph or telephone line, even far enough away to prevent danger of contact, is sometimes an undesirable neighbor because of the inductive disturbance it creates. Transpositions in the power wires, when parallelism is of any length, should be held by telegraph men to be a necessity. Many power lines are transposed anyway, but the practice is not universal, and it is well to make inquiry relative to proposed lines. The great importance of it is illustrated by a recent case, when the insertion of transpositions in a 30-mile parallelism of a 140,000 volt line reduced the induced potential, largely electrostatic, in the telegraph wires from 2,500 volts to 25.

Principally because of decay of poles at the ground line, a time comes when even a pole line kept in the best of condition as regards minor defects must have something radical done to it.

While the strength of a new line is determined by its construction, a line is not new for long, and its strength as time goes on is determined by the amount to which the poles in it are permitted to decay before being strengthened or replaced. For the reason that some lines are more important than others, and that some are subject to more severe weather conditions than others, it seems best systematically to maintain lines at different strengths under different conditions.

A simple system for doing this has been devised, and the specifications will soon be issued. Under this system the lines will first be consistently graded with reference to their importance and to the storm conditions to which experience has shown that they are liable to be subjected. Subsequent inspection to determine what work should be done on any line will be done in accordance with the specified requirements of the grading indicated.

The plan of replacing poles by building a complete new line of poles and abandoning the old poles has its advantages, but it has the serious disadvantage either of wasting a lot of good material in the poles or of allowing the line to be in a very weak condition for some years. A better plan seems to be to do some work, after the line gets to a certain age, every three years or so.

With regard to the organization for doing reconstruction work, a plan which is in effect on many railroads under which the railroad company, although obligated by its contract to furnish the unskilled labor for such work, asks the telegraph company to obtain the labor and bill the railroad company for it, has worked very successfully. The telegraph company is thereby enabled to handle its whole gang as a more permanent unit, to organize it better and get more efficient work out of it. It is believed that in many cases this plan will be most economical for both the railroad company and the telegraph company.

Sunny Describes "Youngstown" Board

The popularity of the "Youngstown" switchboard—so called because the first of its kind was installed in the Ohio town of that name—is gaining throughout the central states, according to B. E. Sunny, president of the Chicago Telephone Company.

The "Youngstown" board was jointly produced by A. P. Allen and E. H. Bangs, of the staff of Chicago telephone engineers.

Retaining the best features of the prevailing switchboards, the Youngstown type embodies the following advantages:

A self-acting switch connects the operator's telephone with the calling party's line, involving but a single motion with one hand, on her part, to answer a call, and preventing her from attending any other line in the meantime. "One thing at a time" must be her rule, and that a very simple thing which easily can be done well. The new operating system insures that "You're next." The operator cannot plug out your calling light and then answer somebody else, leaving you unanswered. "Plugging out lights" is one of the defects of the old manual system. Now a girl must finish one call before beginning the next. A new self-acting switch does the business.

Mr. Sunny says, "The record for rapid operating was formerly 325 calls an hour. With the new switch-

board a girl has handled successfully and accurately 475 calls in one hour, and this without undue fatigue. A conservative estimate based on extended records demonstrates that the average number of calls handled is more than 20 per cent higher with the improved switchboards.

"Particular credit attaches to these improvements because of the fact that no greater portion of the work of operating has been shifted on to the patron. Our subscribers are not required to do anything more than they did before. The habitual method of making calls has not been changed. The decrease in operator's labor is an actual net saving."

Telephone Stock at Easy Rates

In order that the employes and patrons of the Dakota Central Telephone Company may become stockholders in the corporation, J. L. W. Zietlow, president, has prepared a proposition which he believes will offset the criticism that has been made against the company in the past for disposing of preferred stock only to large stockholders.

Commencing at once, the telephone company will issue to any one preferred stock coupons in five dollar and ten dollar denominations, each bearing 6 per cent interest. These coupons can be exchanged for preferred stock certificates drawing 8 per cent interest, payable quarterly, when $100 worth of coupons, or part coupons and part cash, are presented.

The coupons or certificates can be redeemed at any time the holder so desires, with the understanding that no interest will be allowed if withdrawn within six months after issue.

Mr. Zietlow calls the new plan "a profit sharing offer," and says that the preferred stock of the company has heretofore been taken exclusively by the stockholders, and that the management wants to give its employes and patrons the same opportunity.

"This seems to be a good way for persons of limited means to accumulate something that can be turned into cash at any time. This saving feature is often overlooked by the average man, but all of our 'self-made' men started in this way," said Mr. Zietlow.

Puts Ban on "Wake Up" Calls

The Asheville Telephone and Telegraph Company, Asheville, N. C., has issued orders stopping the custom, hitherto practiced by operators, of calling people at stated hours in the morning; of telling "where the fire is," and of giving information not directly connected with the telephone system. The single exception now practiced is that of telling people the time of day.

"We can't do everything the people want us to," said an official of the company. "Every day we tell three or four thousand people the time of day. Even this has got to stop eventually, although we are doing it now.

"We really quit calling people because of complaint on the part of our customers. They would make complaint if we missed the correct time by ten minutes, and threaten to sue if we didn't call them at all. What was simply a courtesy on the part of the individual operators and not a recognized custom by the company had grown in extent till we were calling forty to eighty persons daily. And sometimes we would get the wrong person to the telephone in the 'wee sma' hours.' There was a reason for stopping."

Collects Telephone Pioneer Autographs

L. F. Duggan, a district superintendent of the Missouri and Kansas Telephone Company, has a fad which he has begun to exercise strenuously of late. The fad is, collecting autographs of pioneers in the telephone business. To qualify as a pioneer, the signee must have twenty year's company service to his credit. The fad list boasts of fifteen signatures which it has taken Mr. Duggan, several months to collect.

The name of Alexander Graham Bell heads the list. Another signee is Miss Marion D. Ray of Kansas City, Mo., who went into the business 28 years ago. She is now chief clerk in the treasurer's department of the Missouri and Kansas Telephone Company in Kansas City.

The roster up-to-date comprises the names of: Alexander Graham Bell, of Washington, D. C.; Theodore A. Vail, president of the American Telephone and Telegraph Company; Charles W. McDaniels, 1879, of Kansas City, assistant to the first vice-president of the Missouri and Kansas Telephone Company.

J. W. Wilson (1885), assistant general commercial superintendent of the American Telephone and Telegraph Company; R. B. Cochran (1884), district manager at Hutchinson, Kansas; F. C. Simpson (1890), until he died two months ago, purchasing agent of the Missouri and Kansas Company W. W. Johnson (1884), formerly general commercial agent of the Missouri and Kansas Co.; Miss Marion D. Ray (1884), in the treasurer's department in Kansas City; P. W. O'Brien (1880), manager of the 'phone company at Leavenworth; H. J. Carl (1880), in Kansas City; E. B. Field (1880), president of the Mountain State Telephone Company of Denver; P. Kerr Higgin (1881), with the Southwest Telephone Company of Texas; H. Louis Hoffman (1888), engineer for the St. Louis Telephone Company; A. Barret (1883), district manager at Pleasant Hill, Mo.

All those who have signed Mr. Duggan's roll are members of the Telephone Pioneers of America.

Telephone Dispatching on Portland Electric Line

The Portland (Oregon), Railway, Light and Power Company has recently placed an order with the Western Electric Company for apparatus to be used in equipping its electric inter-urban railroad lines with telephone train dispatching equipment of the latest and most efficient type. In fact, apparatus of another make, at present in use on one of the divisions, is to be dispensed with and the new apparatus installed in its place.

One division to be equipped extends from Portland to Cazadero, Oregon, a distance of approximately forty miles, while the other is the Mt. Hood division, extending from Portland to Bull Run, a distance of approximately thirty miles. The dispatcher will be located at Portland.

Seventeen way-stations in all will be equipped with No. 102A selector sets, containing the standard Western Electric No. 50 type selector. The circuits, however, are so arranged that an ultimate of 36 stations can be equipped with selector apparatus.

Handling and Recording Supplies

By W. G. Higgins*

THE supply department of the Western Union Telegraph Company operates four supply warehouses, located at New York, Chicago, Chattanooga and San Francisco. Its headquarters are at New York. It is probable that additional warehouses will be established at Dallas and Denver. A supply department properly organized and operated bears an important part in the success of the operating departments. Aside from the necessity of having a sufficient, but not too large a stock of material for current and normal demands, there is always what is called "rush service" or "emergency demands." An important piece of construction work must be completed in a comparatively short space of time, lines damaged by storm or flood must be replaced, or a manager finds himself without supplies with which to carry on the business; all must be specially cared for, and at once.

Articles regularly used in our service are with few exceptions, contracted for in yearly quantities. By this means we obtain minimum prices. The usage throughout the entire country is recorded at New York for use in preparing figures for future contracts. All material and instrument contracts are first submitted to the engineering department for approval as to type —thus promoting the matter of standardization, which is at present receiving careful attention.

Prompt service from the supply department is more or less hampered by delays in the preparation of requisitions in some properly scheduled manner. If the writers of requisitions properly anticipate their requirements the supply department is enabled to make prompt deliveries with a minimum of expense. A recent innovation which would help remedy these difficulties lies in the authority given district superintendents to send requisitions covering periodic supplies direct to the supply department; another remedy is the proper scheduling and use of the combined requisition (doubtless familiar to all) by both the superintendents of telegraph and district plant or commercial superintendents. If these combined requisitions are prepared correctly and in due season, troubles will be lessened.

As regards requisitions for line construction material, we have been endeavoring to reduce the time consumed in the approval of estimates and the preparation and passing of the supporting requisitions through our operating and engineering departments to the supply department. One step in this direction has been the authority given each general superintendent to approve estimates and secure the material therefor when the value does not exceed $500. A second short-cut is an arrangement with the engineering department whereby the supply department is advised of any large quantities of material covered by estimates just approved. Such material is placed aside either at the manufacturer's or in our warehouses, and is at once available upon receipt of the requisitions supporting the estimate. The movement in this direction has been retarded somewhat by our work with the Interstate Commerce Commission in the standardization of our accounting systems. When this work has been completed, further changes will be introduced to facilitate the approval of construction estimates and the approval and passing of the supporting requisitions.

Regarding requisitions for instruments, the most important feature for 1912 is the proposition of obtaining them rapidly enough to meet the increased demand. During 1911 the demand for instruments of all kinds greatly exceeded existing supplies and the immediate resources of the manufacturers. Instruments for 1912 are being purchased under large contracts and with a clearer knowledge of future usage, we expect to obtain sufficient stocks of all types.

During the past eighteen months arrangements have been completed whereby a careful inspection is made by the engineering and supply departments, under approved standards, of a majority of the articles purchased. Articles not inspected are relatively unimportant in the service. Inspection work is carried on in two ways; first: inspection at the factory or point of delivery, and secondly: inspection after delivery at the supply warehouse. Materials purchased in large quantities, such as wire, pole line hardware, poles, crossarms and instruments of most types are inspected either at the factory or loading point. Stationery forms used in large quantities, such as our message blanks for instance, are also inspected at the printer's. Material regularly inspected at the factory will not be accepted at the supply department unless it bears proper evidences of inspection. Instructions have been issued by the engineer to employees in the field regarding the evidences of inspection which should appear on the goods. Thus the company is properly safeguarded in the quality of materials delivered on its orders.

It will doubtless be interesting to know something regarding the investment in the supply department of a large corporation like the Western Union Telegraph Company. A consideration of this feature may offer a new viewpoint to those who consider that the amount of material carried in a supply warehouse is limited only by the strength of its floors. On November 30, 1911, we had on hand stocks valued at approximately $825,500, of which $488,000 represents material carried in the main warehouse and $337,000 poles and crossarms carried in the distributing yards. The average monthly disbursements by the supply departments to the operating departments of warehouse material during the previous six months was $168,931, which means that on this class of material the supply department investment was being turned over slightly oftener than four times per year. The investment on November 30, 1912, in poles and crossarms was approximately $337,000, and the average monthly distribution to the operating departments $26,881, representing an investment which would not be turned over for twelve and one-half months. A normal stock of poles and crossarms, because of the difficulties in obtaining them, should last six months; therefore, the additional six and one-half months' stock

*Abstract of paper read at the annual convention of the Association of Railway Telegraph Superintendents, New York.

is an excess. This is accounted for by the heavy purchases made in 1906 in anticipation of continued activity in line construction, which, as you know, has not materialized in the years following the depression in 1907, also the reduction in the lengths of poles used in ordinary construction work. The consolidation of these investment figures covering warehouse material, poles and crossarms and of the distribution figures for the same materials indicate that on all supply department material the investment is being turned over three times each year. Our investment figures will be further reduced by a recent arrangement with manufacturers with whom our contracts are placed, whereby they carry a considerable stock in advance of all our requirements. We then determine upon the smallest amount which it would be fair to ask them to ship direct on field requisitions. This not only reduces our warehouse investment, but the cost of handling as well. Some just criticism has been offered of our allowances for old instruments returned. We have made yearly contracts with New York concerns covering repairs to maximum quantities. All old instruments from all supply warehouses, excepting San Francisco, have been consolidated at New York and all future instruments returned except from the Pacific Division, will also be shipped to New York; thus not only maximum quantities can be repaired, but the instruments can be turned over to the repairers without delay. The credits allowed for standard instruments will be the current cost of the new instrument minus the cost of repairs, minus a fair percentage for handling and supervision at the supply department.

We have gone a step further by the establishment at San Francisco of a trial repair shop in which instruments returned by the Pacific Division will be repaired and it is believed that this will ultimately result in the establishment of similar shops in all divisions and the reduction of present repair costs.

A feature of our business which deserves careful study by all concerned, is the matter of excess stocks. Much has already been done to obtain information in regard to excess stocks of line construction material and instruments in the possession of our plant superintendents. The plan utilized is as follows: Each month each district superintendent prepares a list of "overstock" in his district (the word "overstock" in the absence of special consideration, means broadly, a quantity in excess of a six months' supply, although special considerations may change this application). This monthly report is forwarded to the division superintendent. The division superintendent compiles monthly the lists from all districts and forwards a complete copy to the supply department. The district superintendent will not order material for one portion of his district, which his list indicates is an excess in another; the division superintendent will not order material for one district which can economically be transferred from another district, and the supply department will not invest money in new material required by one division which can economically be transferred from overstock existing in another division. Working on this theory the supply department disposed of field overstocks during 1911, which it is fair to assume would not have been moved otherwise, amounting to about $152,000. The next necessary step is to obtain information from the superintendents of telegraph regarding overstock (owned either entirely or jointly by the Western Union Telegraph Company) in the possession of railroad companies. How this information can best be obtained has not as yet been determined and the methods adopted will probably be the result of consultation between the members of this association and our plant representatives. It has been suggested that the proper amount of stock to be carried by each railway can be determined on a unit basis from the number of miles of pole right-of-way along the line of that road. If this suggestion is ultimately followed, the proper supervision of such stocks by the plant department would be considerably simplified.

The Flying Office

In the annals of naval and land warfare we have heard much of "flying squadrons." It remained, however, for the telephone to make it possible for railway officials to have what may be termed a "flying office." A prominent railroad official recently said: "We railroad men don't have to be tied down to our city offices any more. We can get around over the lines, and see what is going on with our own eyes. Neglect our routine business? No much! We do just as much, if not more, with modern methods."

This is all brought about by the fact that the private cars in the United States equipped with Western Electric telephones may be connected at each stopping place to the telephone line by means of a line pole. Over the telephone circuit thus established, the official transacts his routine business as well as takes care of any emergency which may arise. He dictates his memoranda, and even his more lengthy letters, to his secretary or stenographer, who is at headquarters. His private car is his office and, without neglecting every-day matters, he can make inspections or personally supervise any work, such as clearing up a large wreck, the replacing of a bridge or the clearing of a snow or land slide, while keeping his finger upon the "pulse of the road."

In the days before the telephone began to supplant the telegraph for dispatching the message work on railroads, this would not have been possible, for even if a temporary telegraph circuit had been rigged up, it would have been necessary to employ experienced operators at both ends. This would have meant that a personal message between the general manager and the superintendent would have had to pass through two intervening minds, which would of course have detracted from the personal-touch element. This is one of the many points wherein the telephone is vastly superior to the telegraph for use on railway systems.

Claims Telephone Lead for Des Moines

"The telephone situation in Des Moines is more complicated because Des Moines makes greater use of the telephone than any other city of the country in proportion to the population," according to Mayor James R. Hanna.

"Des Moines greatly exceeds the average for the United States. The local exchange claims 17,000 subscribers or about 20 telephones for every 100 population. According to the records the people of this city make greater use of their telephones than any other American city, the calls per station averaging 8.3 per day."

Telegraphones on the Great Western

By G. O. Perkins*

SINCE the advent of telephone train dispatching, we see little in print about the telegraphone, yet there is a large field in which that useful and inexpensive device can be used to excellent advantage. Recent improvements have so increased its efficiency that telegraphone circuits are successfully operated under conditions which have heretofore been prohibitive. Nearly every railroad has territory where the volume of traffic does not justify the expense of installing telephone train dispatching circuits, yet the improved communication afforded by telegraphones will so reduce operating expenses that the installation would pay for itself in a few weeks.

The first extensive telegraphone installation on the Great Western was made on the Western division. The only wires available were No. 8 iron with telegraph instruments cut in at every station. Circuits were established as follows: Clarion to Oelwein, 100 miles with five telegraphone stations; Clarion to Hayfield, 100 miles with five telegraphone stations; Clarion to Carrol, eighty miles with five telegraphone stations; Carrol to Council Bluffs, eighty miles with four telegraphone stations.

At Clarion the three circuits are equipped with extension howlers and terminate in a jack box. Two instruments, one for the exclusive use of the dispatcher and one for general use, are provided. Either instrument may be used on any of the three circuits by plugging in at the jack box.

At Carroll, one telegraphone and one extension howler are so arranged that they may be transposed from one circuit to the other by means of a double-pole, double-throw switch.

Instruments were installed permanently in all cabooses, and portable telegraphones were furnished for passenger trains. The results obtained have been highly satisfactory. During the unprecedentedly severe weather of the past winter the telegraphones proved veritable life savers. In every case of trains stalled in snow-drifts or stopped by other causes, the conductor was in communication with the dispatcher in less than five minutes, and relief trains were started without delay. This meant not only saving in time but saving in men, who otherwise would have been obliged to endure the exposure of tramping possibly five miles to a telegraph station during a blizzard with the thermometer forty degrees below zero.

In several cases where the telegraph service was completely interrupted by crossed, broken and grounded wires, train orders were issued without difficulty by telegraphone to points beyond the interruptions.

Telegraphones have also proved of great benefit to the maintenance of way, mechanical and traffic departments, and have noticeably reduced the burden on the telegraph wires:

Circuits on the Northern division were arranged as follows: (1) St. Paul to Red Wing, fifty-eight miles No. 8 iron wire, seven telegraphone stations; (2) St. Paul to Oelwein, 187 miles, No. 10 copper wire, four telegraphone stations; (3) Red Wing to Rochester, forty-nine miles, No. 8 iron wire, three telegraphone stations; (4) Randolph to Mankato, sixty-seven miles, No. 8 iron wire, three telegraphone stations.

The superintendent and dispatchers are located at St. Paul, and the assistant superintendent at Red Wing. Circuits 1 and 2 pass through Randolph and No. 4 terminates there. Switches are installed at that point by means of which either Red Wing or St. Paul are given direct telegraphone communication to Mankato without disturbing the telegraph circuits.

On the Southern division pole line there are from fifteen to eighteen duplexed and quadruplexed wires, and the inductive disturbance is so severe that standard telegraphones cannot be used for distances greater than fifty miles. The only wires available for telegraphone purposes are No. 8 iron, and over a large part of the division they have telegraph instruments at every station. To meet these conditions, a special telegraphone has been developed and has made possible the successful operation of the following circuits: Des Moines to Oelwein, 132 miles, No. 8 iron wire, four telegraphone stations; Des Moines to Conception, 120 miles, No. 8 iron wire, four telegraphone stations; Conception to St. Joseph, forty miles, No. 8 iron wire, four telegraphone stations; St. Joseph to Leavenworth, thirty-four miles, No. 8 iron wire, six telegraphone stations.

An experimental circuit, Des Moines to St. Joseph, 160 miles, on No. 8 iron wire with thirty intermediate telegraph offices on the wire, worked successfully. The special features of the new telegraphone consist of a high efficiency transmission device with push button, such as that used on telephone train dispatching circuits; also a double head telephone with a receiver for each ear, and an improved method of eliminating telegraph inductive disturbance from the receivers.

*Great Western Employees' Magazine.

Demands Lincoln Connection Be Rushed

In an effort to compel the Lincoln Telephone & Telegraph Company to inaugurate the single telephone system program in Lincoln at once, City Attorney Fred Foster asked the city council for permission to press the matter before the state railway commission.

He asked the city council to authorize him to request the railway commission to make an order putting two propositions to the company. The first proposition is:

The immediately physical connection of the manual and automatic lines.

The alternate proposition is:

The prohibition of the collection of rentals on Bell telephones after September 1.

According to Foster's ideas, the company could proceed with greater rapidity toward the connection if the officials so desired. He believes that such an order from the commission would result in a single telephone system in Lincoln soon, which will not only be of convenience for the public but will save thousands of dollars every month to the business concerns, which are compelled to subscribe for both telephones.

If the income from the Bell telephones is cut off, it is said, it is clear that the company will eliminate this system as quickly as possible.

The form of procedure makes it necessary for the council to order the city attorney to appear before the state railway commission and make request for an order such as will bring about the desired results.

Of Interest to the Trade

By A. L. Haase

Automatic Enters Railroad Field

The Automatic Electric Company does not boast of 34 years in the telephone field; but it has been an active figure in telephone work for the past 17 years, and four millions of calls are now made every 24 hours over apparatus turned out of its factory. This factory is located at the corner of Morgan and Van Buren streets, Chicago, only eight blocks west of the justly famous Chicago river, which divides the city.

John H. Finley.

This energetic branch of the telephone industry has now made a new departure in its work and proposes to take up the supplying of telephones, selectors, line material, and an economical private branch exchange system to as many railroads as can be induced to see the light in the same way the company sees it.

To introduce this line the Automatic Electric Company's supply department has secured the services of John H. Finley, who has spent 13 years acquiring a knowledge of the subject and the necessary experience to make him useful to the Electric Company and the railroads as well.

Mr. Finley was born in the little, obscure Connecticut town of Sterling, which lies almost exactly half way between Boston and New York. His education was acquired in the common schools in and around his native town and in Andover Academy, Andover, Mass., and Sheffield Scientific School, Yale University, from which school he graduated in '99. Mr. Finley was not born with a silver spoon in his mouth, as the New Englanders say, but had to work his way through school and college and has had to work his way pretty much ever since.

For 13 years he labored in the old school of the Bell Company, the Western Electric Company, in various capacities, as shopman, installer, engineer, and finally salesman to the railroad trade.

His thorough knowledge of the telephone business from a manual standpoint, coupled with the facilities at his command, from an Automatic standpoint, should make him a valuable man both to the Automatic Electric Company and the railroad men now just entering the new field.

Mr. Finley's services are at the command of the railroad companies, both in the United States and Canada.

The Automatic private branch exchange will be a leading feature in the railroad field in the next few years, as a very material saving is claimed in its operation over the manual exchange, and when the first rush of the telephone work recently thrust upon the attention of the superintendent of telegraph is over, possible economies will be the next phase to be studied. Mr. Finley is confident that the automatic exchange alone when possible, and in conjunction with the manual where necessary, is one of the answers to the economic problem now confronting all railroad men, from the president down.

"Neighborhood News

Following out the idea of last season's advertising campaign in the rural papers, The Kellogg Switchboard and Supply Company is distributing a splendid four-color reproduction of a pen etching by Vallely, "Neighborhood News." The subject of the last series of farm copy being entitled "Talk to Your Neighbors Over Your Own Line."

"Neighborhood News" shows the interior of a typical farm kitchen and a living room with the farmer's family group around a Kellogg No. 2696 magneto wall set. The subject of the discussion, judging from the interested expression of the listeners, is "Neighborhood News."

The open door shows the farm porch and barn yard with industrious hens in the distance. The corn drying in the rack in the corner gives an added touch of realism.

In the corner of the card is found the well known slogan of the company, "The service of the telephone proves the worth of the line." On the reverse side is the following description of the farm telephone and its usefulness:

"Painters, poets and writers have brought before us inimitably the delights and shortcomings of the rural home. The farmer's life, from chores to chores, in fair weather and storm, has been pictured innumerably on canvas and in prose and poetry for our benefit. But no man living except the farmer himself knows the real feeling of sociability, of friendliness and of safety that the farm telephone inspires. Its value cannot be measured in dollars and cents, nor in time saved or crops sold.

"The telephone has driven loneliness from the country side. It has, more than anything else, done away with out-of-date agriculture—the telephone farmer is the business man.

"But, just as good stock and first-class machinery spell the difference, oftentimes, between success and failure, so the best quality telephone renders a service not to be compared with cheap apparatus or the few pennies saved in its first cost.

"Kellogg telephones are guaranteed for five years. They are simple in construction, built of the best material and unsurpassed in all conditions or climates.

"We have a little book that tells in plain words all about the farm telephone. We will send it to you promptly on request, and will assist you, if you are interested in this work, in every way we can."

The Kellogg Company will be pleased to send these cards to those interested.

Another card, entitled "Many a Truth is Spoken in Jest" is a take-off on "Humpty Dumpty" to bring out the indestructible qualities of the Kellogg desk stand as follows: "An old fashioned desk stand sat on the wall. An old fashioned desk stand had a bad fall. And all the king's horses and all the king's men couldn't put this old desk stand together again."

"Kellogg desk sets have proven from long experience that, whether they are stood on a wall, a desk or a table, they will give lasting, reliable service. The Kellogg desk stands, with steel reinforced rubber mouthpiece and steel reinforced rubber receiver shells, are unbreakable in telephone service. They are efficient up-to-the-minute telephones for every class of service in all climates. The handsomest, most symmetrical of any on the market. Today, now, telephone, wire or write your order for a Kellogg desk set. A Kellogg desk stand is a real asset to the subscriber—to the exchange to which it is connected, and to us—because it is a live—a speaking advertisement for better telephones.

"Remember,

" 'The service of the telephone proves the worth of the line.' "

These cards also are furnished on request.

"Railway Telephone Cords" is the subject of an attractive illustrated six page folder, tastefully printed, in two colors on buff colored stock.

The important idea emphasized is "That Kellogg moisture proof cords are water proof—they last longer."

Various tests and practical experiences with Kellogg moisture proof cords are given and illustrated graphically.

With this folder goes a code list of the more important Kellogg cords, and also a list of moisture proof cords, "for competitor's equipment," with a return postal card facilitating inquiries from interested recipients.

These cards sent promptly on request.

Incidents in Cable Manufacturing

The first cable of which there is any record was laid at Birmingham, England, in 1837. It was composed of a number of guttapercha covered wires encased in an iron pipe. Owing to the imperfect protection afforded by the pipe its life was very short.

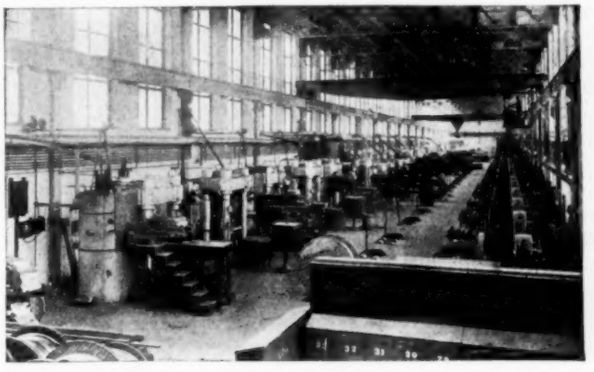
During the next half century the problem of an efficient protective outside casing for the wires remained the most difficult one in cable manufacture. The period from 1837 to 1880 was largely one of experiment. Many varieties of telegraph and telephone cables were tried out during that time, but all developed that fatal defect of being non-moisture-proof when laid underground.

In 1880 a cable was finally introduced which attained some measures of success. It consisted of cotton-insulated copper wires bound together and drawn into 200-foot sections of lead pipe; the interior of the cable thus formed was then thoroughly saturated with paraffine throughout its entire length.

It was with one of this type that the Western Electric Company began its manufacture of cable in 1882, and continued with little change until 1891, when paper insulated conductors were introduced. The substitution of paper insulation for that of wool or cotton resulted in such a remarkable improvement in transmission and such a decided reduction in cost, that the paper core cable has almost completely displaced the older types.

Of the four principal manufacturing operations through which cable passes—insulating the copper wires, pairing the insulated wires, winding the wires into a cylindrical core, and sheathing the core—the insulating and sheathing process only have undergone important changes.

The insulating operation was radically changed when the use of paper was inaugurated, a new design of insulating machine becoming necessary. The first method of applying paper insulation was to pull the wire through a die which folded a ribbon of paper lengthwise around the wire. Spirals of different colored threads were then wound around the insulated wire in order to keep the paper binding in place, the various colors serving to distinguish the different pairs of



Cable Presses at Hawthorne.

wires. This method is still employed by foreign manufacturers in the insulation of the coarser gauges of wire.

In America, however, it was almost immediately replaced by the present method, in which the paper ribbon is wrapped spirally around the wire; the covered wire being afterward run through a bushing ("polished") in order to bring it to the required diameter.

The first type of machine used for this purpose was necessarily slow, as the supply of paper that was wound on a comparatively small bobbin could not be revolved about the wire at a very high speed. About 1897, however, a much faster machine was developed. In this, a revolving disk carries a pad of paper tape upon its face. As the disk and the pad revolve together, the paper is unwound at the same rate of speed, regardless of the size of the pad. The design of this machine has been constantly improved, until at present the paper insulation can be wound around the wire at the rate of 2,800 turns a minute.

The lead sheathing operation was, in the beginning, a very tedious and expensive process. At that time the lead pipe was purchased in approximately 200-foot lengths. Four of these usually constituted a cable length, and were laid out straight on the floor to receive the core. In order to start the cable core through the sheath, a ball attached to a cord was

forced through the pipe by means of a hand air pump—something like a bicycle pump. To the cord was attached a rope, by means of which the cable was drawn through.

The men employed to do this kind of work had to be a combination of sailor and plumber, as they had first to pull the core into the lead sheath, and then solder the joints. The plumbing work followed the "drawing-in" operation, the ends of the pipes being brought together and the joints wiped in the regular way, except that the diameter of the joints was made as small as safety would allow.

After the sections had been joined, the length of sheathed cable was wound on a drum and placed in an oven. Here, by means of a vacuum, melted paraffin was forced through its entire length, until the core was saturated. The finished cable was then rewound on wooden reels ready for shipment.

In 1892 this slow and laborious process was replaced through the efforts of W. R. Patterson, of the Western Electric Company. By an ingenious invention known as the "die block" he made it possible to form a continuous lead sheath around the core as it passed through a chamber filled with plastic lead. This process, which gave the name "Paterson cable" to the product, is, with some improvements in the die blocks and presses, still employed in forming the sheath.

The change to a continuous sheath made it possible to omit the saturation of the core with paraffin, as the cable could be taken direct from an oven and passed through the presses, without any danger of its taking up moisture.

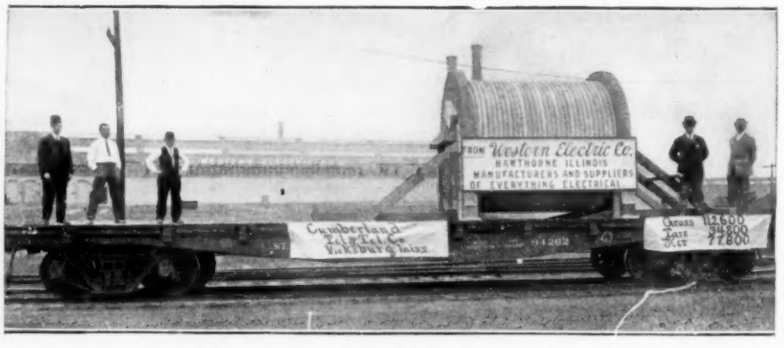
Reel Record Breakers

This is an age of record breaking. We have record breaking buildings, each new one exceeding older ones in height; there are new ocean steamships breaking size and time records and there have been new world's records made in athletic contests. The Western Electric Company announces that it recently broke two of its own records in sub-marine cable manufacture, within six months of each other.

In February of this year, what was then the largest reel of armored submarine cable ever manufactured was shipped from the Hawthorne works. This was a 37-pair, No. 13 gauge armored cable containing approximately 80 miles of copper conductor and forming a continuous cable 5,500 feet long. The weight of cable, reel and blocking to hold it on the flat car was 38 tons. The reel heads were 9 feet in diameter and 9 feet apart. The cable was laid in Galveston Bay, Texas, connecting the lines of the Western Union Telegraph Company from Virginia Point to Galveston Island.

That was an achievement; but a greater one followed six months later when the Western Electric shipped to the Cumberland Telephone and Telegraph company the largest reel of duplex armored submarine cable ever turned out at the Hawthorne works. The cable contained 26 pairs of No. 13 gauge copper conductor made up into a cable 4,500 feet long. To manufacture the cable there were required over 1,000 pounds of paper, 15,000 pounds of lead, 47,000 pounds of wire and 7,500 pounds of miscellaneous material. The gross weight of the reel with its blocking was 56 tons or over 18 tons more than the first one described.

The cable has been laid across the Mississippi below Vicksburg, Miss., connecting the toll lines between that city and Shreveport.



The Biggest Reel of Submarine Cable.

U. S. Bureau Helping Foreign Trade

The growth of the Bureau of Manufactures and the number and interest of those who make use of its facilities are well indicated, states A. H. Baldwin, chief of the bureau, in his annual report, by the increase in the correspondence of the bureau during the fiscal year 1912, when 65,881 letters were received and 59,198 were dispatched, a gain of more than 45 per cent over the preceding year. As with few exceptions each letter received contains a request for definite information or for special publications, this record shows a noticeable growth in the appreciation by commercial interests of the value of the information distributed.

The bureau is best known perhaps through its publication of the *Daily Consular and Trade Reports*, the mailing list of which has now reached the limit fixed by law and many requests for which can no longer be granted. It reaches 20,000 firms and individuals direct and hundreds of thousands indirectly through trade journals and daily newspapers, and is probably more widely quoted than any other daily in the country.

One feature of the bureau's work that is of particular interest and value to American manufacturers and exporters is the "trade opportunity" service, by means of which they are given specific information as to openings for American goods in foreign countries. During the year 32,869 copies of these trade opportunities were mailed to inquiring firms, as compared with 20,043 in 1911. Another method of acquainting American dealers with information as to foreign markets is through the use of confidential circulars, which are distributed to firms and individuals especially interested in the subjects treated. In 1912 over 100,000 copies of confidential circulars were mailed, a considerable increase over the number distributed during the preceding year.

Probably the most important service that the bureau rendered during the year was in the conference at which there was organized the Chamber of Com-

merce of the United States of America. For a year or more the bureau has been collecting information in considerable detail in regard to commercial organizations, their functions, membership, and other facts, and this knowledge was of great use in the preparations for the conference. At the present time more than 100 organizations, representing over 100,000 members, have become affiliated with the new chamber and it is believed that a most favorable opportunity is now presented for the development of a truly representative national commercial organization.

The work of the commercial agents of the bureau in foreign fields was continued during the year and an investigation was also made of the various activities of commercial organizations in certain parts of the United States, especially those activities related to the development of foreign trade. A report on the general subject of commercial organizations will soon be issued. Investigations in foreign fields include those of the trade in cotton goods, machinery and tools, shoes and leather, and lumber and its manufactures. Foreign chemical and electric industries were also the subject of study by experts in those lines. Reports on these subjects have been issued or are in course of preparation. The chief of the division of foreign tariffs investigated the tariff systems of Latin American countries, a report on which will be issued in monograph form.

Under the changes in the law which have recently been made the Bureau of Manufactures and the Bureau of Statistics have been merged in the Bureau of Foreign and Domestic Commerce and given a material extension of service. This new name is admirably descriptive of the field of the work of the bureau. With adequate resources there can be developed promotive activities almost without limit, and there will be provided a logically designated branch of the Department of Commerce and Labor which may respond to the rapidly growing demand by commercial interests for the exercise by the department of its primary function of fostering, promoting and developing commerce.

Chase Truck Business Good

The Chase Motor Truck Company, Syracuse, states that it is doing practically double the amount of business it was doing just a year ago at this time. The various models are all enjoying an active sale, particularly the one-half ton and the one-ton trucks. The great increase in business at this time is somewhat surprising to the management, considering that it is a presidential year, when business conditions are not always considered to be of the brightest.

In New York City and certain portions of the South there has been a marked increase in the sales of the heavier Chase models, due in the first instance, no doubt, to heavier traffic demands, and in the latter to the general poor conditions of the average southern road.

New agencies have been established at Johnstown, Pa.; Rock, Mass.; Burlington, Ia.; Albany, N. Y.; Springfield, O.; Fremont, O.; Memphis, Tenn., and Philadelphia, Pa.

Edward A. Kingsbury, secretary and treasurer of the Chase Motor Truck Company, has recently returned from a successful trip to Philadelphia, where he completed arrangements for the new Chase agency under the supervision of J. A. Rogers of that city. This agency has chosen a particularly fine corner at Broad and Wallace streets, on the main thoroughfare of automobile travel in Philadelphia, and in the very heart of the truck district. In addition to the agency, Mr. Rogers will maintain a service station in the immediate neighborhood, and E. F. Howell, the Philadelphia district manager, will make his headquarters at the same location as the agency.

General Alarm for Telephone Systems

In manufacturing plants, public buildings and schools or other institutions which have private telephone systems or are planning to have such a system there is frequently need for a device which will ring a number of bells or buzzers simultaneously. Such a device has been perfected by the Western Electric Company, in what it terms "general alarm or code signaling sets."

General Alarm Signaling Set.

The functions of the sets, which will probably find their greatest application in connection with private branch exchanges and inter-phone systems in business houses, factories, hospitals and schools, will be to call to the nearest telephone any one of a number of men by an arbitrary selective code, to sound an alarm in case of fire or other emergency, and to sound bells for recess or recitation periods. The sets may also be used independently of telephone systems.

The signaling set may be mounted at any central point and bells and buzzers scattered wherever signals are to be given. A simple turn of a key handle will sound a call simultaneously on all the bells and repeat the call four times, each key sending out a different code signal. The sets can be connected into the telephone or inter-phone system together with an auxiliary resistance and condenser box. They are furnished in any capacity up to ten different signals.

Central Battery Telephone in Spain

The need for the very best kind of telephone service is making itself felt in Spain as it is in other countries. The second central or common battery switchboard is shortly to be installed in the northern part of the Iberian peninsula at Pamplona.

The first central battery installation in Spain was made about four years ago in the sea coast city of San Sebastian, separated from Pamplona by the Cantabrian mountain range. This equipment was manufactured and installed by the Bell Telephone Manufacturing Company of Antwerp—the Belgian concessionaire of the Western Electric Company of the United States. It consists of an eleven-section multiple switchboard of the relay central battery type with a capacity for 2,000 lines. The initial equipment was for 650 lines and required eighteen operators.

The equipment to be installed at Pamplona is also

to be furnished by the Bell Telephone Manufacturing Company of Antwerp and consists of a number of sections of what is known as the No. 10 central battery switchboard. This is a lamp signal relay board employing a cut-off jack in place of the cut-off relay used in the No. 1 type.

A New Sectional Unit Switchboard

The necessity for private telephone systems in homes, business offices, factories, and institutions such as schools, hospitals, prisons and asylums is becoming more and more universally acknowledged Intercommunication is coming to be looked upon as the most efficient way in which to get results within an organization.

The Western Electric Company has developed and placed upon the market an intercommunicating switchboard—the No. 1801—of a distinctly unique type. It follows out the sectional unit idea which has done so much for filing systems and libraries. The purchaser need only buy as much equipment as his present needs demand. When the business expands or the necessity for additional extensions arises, he can buy another scetion of switchboard which will fit in with those already installed.

The No. 1801 sectional unit switchboard was developed to step in when the number of telephones exceeds twenty or is likely to exceed twenty in a short time. The units fit together like those of a sectional book case; and, by adding units, it is possible to make a switchboard of 20, 40, 60, 80 or 100 line capacity. It meets the demand for a switchboard which will be absolutely reliable while inexpensive enough to fit a modest appropriation.

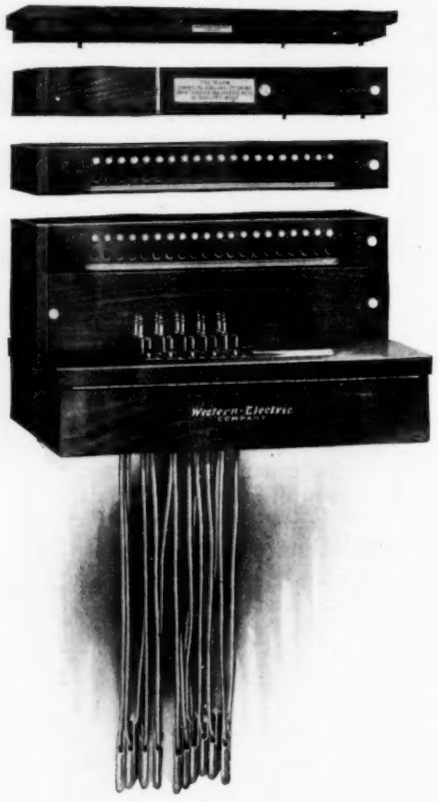


Fig. 1.

One of the features which makes the No. 1801 the ideal switchboard for schools, factories, prisons and other institutions is its arrangement for sounding a general alarm. This is a means of ringing and talking to all stations simultaneously, thus providing a fire or general alarm system without extra cost.

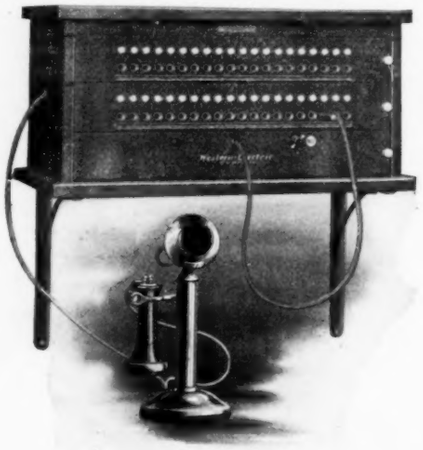


Fig. 2.

Four systems, to give four different classes of service, may be furnished. Two provide a means of connecting in to the public telephone system.

Western Electric Estimates of Year's Business

Earnings of the Western Electric Company continue to run strikingly close to the forecast of the showing for this year made soon after the new year began. It was then figured that 1912 ought to yield a gross business of something like $67,000,000. Returns for the eight months ended with August give an indicated gross business for the year of approximately $68,000,000.

July was about three per cent ahead of the same month in 1911 and August was three per cent ahead of the corresponding month a year ago. The eight months of the current year are also about three per cent ahead of the same period last year. The most interesting feature of the company's business recently has been the tendency of the West to show greater activity. Last winter was severe and as a consequence there was a general slowing down of affairs in the spring and early summer. The weight of the approaching harvest is commencing to make itself felt and consequently there is a greater tendency towards expansive development among those states west of the Mississippi.

New business of the company is greater than the rate of deliveries. On January 1, for instance, unfilled orders on hand totaled $8,000,000 and on September 1, $10,000,000, an increase of 25 per cent. There has been no radical change in the average level of prices for the Western Electric's products recently, yet the company is now realizing a better average margin of profit than a year ago, due chiefly to the many improvements made in both the manufacturing and administrative departments and to careful study of the

principles of operating efficiency and economy. Improvement in business has been fairly evenly distributed both in respect to territory and nature of goods shipped.

About $750,000 will be spent in erecting new buildings at Hawthorne this year to take over the company's New York manufacturing business. The additions will be completed in about a year and are in line with the company's policy of concentration of the manufacturing branches at Chicago.

Export business during August and the last eight months has shown a relatively greater improvement than the domestic business.

The Western Electric in Cleveland

The Western Electric Company's family of distributing houses has been increased by the addition of one in Cleveland, Ohio, as the result of taking over the business of the Cleveland Electrical Supply Company.

The Western Electric Company retains the entire personnel of the supply company which it supersedes, with the exception of R. F. La Ganke, vice-president and manager, who is retiring from active business. H. A. Speh of the Buffalo house succeeds to the post of manager. Louis Griesser, sales manager, has been twenty years in the electrical business at Cleveland. The Cleveland house has, in Mrs. M. L. Hausman, the only saleswoman in the company's employ.

The New Cleveland House.

The new house takes up its work with good prospects. It is probable that a warehouse will be established in the near future for the service of the Central Union Telephone in Ohio. A telephone sales department has also been organized under the supervision of F. E. Triebner, formerly of the electric company's Nashville office.

Denies Report of Merger

General Manager Griffiths, of the Inter-State Telephone Company, has issued a denial statement, from his offices in Aurora, Ill., to the effect that the Inter-State Telephone Company is absolutely independent of Bell or any other outside telephone company interests, and, furthermore, that it intends to remain so.

Mr. Griffiths said: "As evidence of the financial prosperity of the Inter-State Company, in the last thirty days it has purchased thousands of dollars worth of material to build up and extend the present system."

E. T. Teece, the local manager, also declared that the report had no foundation and, in speaking of the extensions of the local plant, he pointed to the fact that extensions would be built to Mechanicsville, Bartonville and Prospect Heights. He further stated that rural lines would be run to all the adjacent farming territories and every effort will be made by the company to make this one of the largest independent telephone plants in the state. It is estimated that the local company will spend in the neighborhood of $100,000 in its new extensions.

Kentucky Commission News

The Kentucky State Railroad Commission has filed an opinion and resolution in the case of the application of the old Kentucky Telephone and Telegraph Company and the Southern Bell Telephone Company to consolidate the Southern Bell by buying the Old Kentucky Company. The resolution recites that before the final order will be entered permitting consolidation the Old Kentucky Company must make a statement setting forth the value of its property, stock and bonds sold and the schedule of its tolls and charges; it must promise to maintain the same service at the same rates and maintain the same connections existing under present contracts, and that these rates shall not be increased except application to and consent of the commission after advertisement in the local paper for a specified time. When these conditions are complied with, a final order will be entered. The Old Kentucky Company operates in Clark and Montgomery counties and the Southern Bell in Winchester alone.

Telephone Pioneers to Meet

A meeting of the general committee of arrangements for the second annual re-union of the Telephone Pioneers of America was held at the Railroad Club, September 24, and a tentative program arranged with regard to the second annual meeting to be held at the Hotel Astor, November 14 and 15.

The first day will be given up to a general business meeting in the morning with addresses by U. S. Bethell, Thomas A. Watson and othes in the afternoon. In the evening a reception will be given the Pioneers by the New York Telephone Society.

The second day will be taken up with an automobile ride of considerable extent with lunch and festivities at a prominent club in the suburbs, returning in time for the banquet at 7:30 p. m.

The committee is to meet again October 15, when a full program will be outlined and a copy sent to each member of the association as soon thereafter as possible.

Checotah Boycott Efficiency

As the result of a town boycott, Checotah, Wyo., is to have a new telephone exchange. The corporation commission issued an order directing the Pioneer Telephone and Telegraph Company to build a new plant and to render the people of Checotah proper service. The new plant will be a common battery system. The Checotah switchboard did duty in Guthrie years ago. It was first sent to Chickasha and next to Checotah. Telephone service in Checotah grew so bad that a mass meeting was held in which the people agreed to boycott the exchange and they left all receivers down and declined to talk over the company's wires when called. The commission's findings show that the Checotah plant does better from an earning

standpoint than towns of similar size. The plant cost about $10,000 and the annual net earnings amount to about $2,000.

Chicago Mayor Favors two Companies

Mayor Harrison came out recently in favor of two telephone companies in Chicago in the first statement he has made on the right of the Illinois Tunnel Company to operate since that company's franchise has been hanging in the balance between the law department and the city council.

The Mayor said he favored the continuation of the company in business because of the benefit resulting to subscribers from healthy competition and what he said would be a natural strife between the companies to improve their service. The Mayor reserved the announcement of his own view until the law department had acted independently, and on the basis of the investigations conducted by Corporation Counsel Sexton approved an opinion which practically set forth that the automatic telephones are here to stay.

A New Use for Conduit

A novel use for clay conduit is reported in a recent issue of the *Western Electric News*, by the Philadelphia house of the Western Electric Company.

A wealthy wool merchant of that city, who is also a "bon vivant," decided to build a wine cellar in his house. He has bought 600 12-inch lengths of vitrified clay conduit and will build the tile ducts into the walls, using them as receptacles for wine bottles. Each piece of conduit, being about a foot long and four inches in diameter, is just the right size to hold a quart bottle comfortably.

This illustrates very clearly the fact that more than one kind of "juice" can be run through a conduit. This may also serve as a hint to architects and contractors.

Spurn Privilege of Half Rates

Mayor James R. Hanna, of Des Moines, is opposed to the present arrangement with the Iowa Telephone Company, permitting city employees to enjoy half rates on telephones. Notwithstanding, the city council continues to grant more such privileges. The mayor wishes to abolish this system and it is expected that he will take a decisive step in this direction in a short time. There are now 260 city employees having half rate telephones. Mayor Hanna and his secretary, Edward C. Lytton, as well as other prominent city officials, have steadily refused to avail themselves of the half rate privilege.

Telephone Increase in France

The Administration des Postes et Telegraphes has decided on the establishment of telephone and telegraph lines in 57 towns and townships throughout France. The following 12 cities have also decided to set up or extend their municipal telephone and telegraph systems: Caen, Rouen, Honfleur, Troyes, Laval, Deauville, Marizy, Levallois, Montagnac, Malakhoff (Seine), Casteljalous and Beauville.

Field Telephone Being Developed

A field telephone for infantry regiments is being developed by First Lieut. G. Tayler, 8th Infantry, who is making his experiments in the Signal Corps laboratory in Washington, D. C. It is to be equipped with small receivers, and about two miles of insulated wire, which can be run along the ground from a hand reel. The telephone will be used in communicating between regiments in intrenchments, and in fact any time when organizations have taken a semi-permanent station before the enemy.

Field telephones were used in the recent Russian-Japanese war with considerable success. With some improvements it is predicted they will become an important part of infantry equipment. These telephones will take up the line of communication where it is left off by the regular equipment of the Signal Corps.

New Jersey Commission News

The New Jersey Board of Public Utility Commissions has issued a pamphlet containing the report and recommendations made by its chief inspector regarding rates of telephone companies. Each telephone company operating in the state will receive a copy and a conference is announced for October 9.

Exhibit of Klein Tools

An exhibit of Klein electricians' and linemen's tools will be shown in connection with the Western Electric Company's exhibit, space No. 414, at the American Electric Railway Manufacturers' convention, International amphitheater, Union Stock Yards, Chicago, October 7 to 12. Those interested should not fail to visit it.

An American consul in a Latin-American country reports that a telephone company in his district anticipates extending its lines between two cities, a distance of about 90 miles, as soon as authorization can be obtained from the Federal Government. A single copper circuit of No. 8 or No. 10 wire will be installed. Copy of the report, containing further details and the names of the persons to be addressed regarding the necessary supplies can be obtained from the Bureau of Manufacturers.

A dispatch from Washington, D. C., gives the information that the supreme court of the United States has been asked to decide if a telephone company may discontinue the service of a subscriber who owes a back bill. Mrs. Amelia P. Danaker, of Little Rock, Ark., got a judgment of $6,300, against the Southwestern Telegraph & Telephone Co. because her telephone had been disconnected 43 days. The company appealed to the higher court.

The number of telephone subscribers in Darien increased to 1,200 in 1911. As soon as the subscription list reaches 3,000 the present supervisory-magnet multiple switchboard will be replaced with the common battery multiple system, such as is now in use in the larger ports of Japan. The laying of underground cables has begun, and a modern system will be installed at a cost of about $50,000.

Brevities of the Business

PERSONAL NOTES.

H. E. Jeffrey of Saginaw, Mich., has been appointed district manager of the Inter-State Telephone Company with headquarters in Aurora. F. H. Cornfeldt, formerly of the General Electric company at Schenectady, N. Y., has been appointed assistant engineer with Aurora headquarters. Mr. Bolder has been named toll auditor, succeeding Fred Weis of Aurora, resigned. The officers plan to spend large sums to develop the plants and seek additional business.

William B. Roberts, division superintendent of the Southern Bell Telephone company, died of typhoid fever Sept. 9 at his residence, 39 St. Charles avenue, Atlanta, Ga. For ten years Mr. Roberts had been connected with the Southern Bell Telephone Company, of which he was one of the most valuable officials. He was known and liked throughout the city. Mr. Roberts was a member of many fraternal orders. He is survived by his wife and two daughters, Misses Jeurdine and Katherine Roberts; his mother, Mrs. Joseph Roberts, and his sister, Mrs. David Kein, both of Napoleon, Ohio.

G. W. Lancaster, of Richmond, Va., has invented a telephone muffler in the shape of a miniature booth within which a person may place his head. The telephone is within the booth, the receiver being mounted upon a supporting arm.

Frank W. Carroll is the district manager of the Mountain State Telephone and Telegraph Company at Ogden, Utah, in place of S. J. Jones who was appointed district manager at Provo, Utah.

W. M. Malburn has severed his connection with the auditing department of the Mountain States Telephone and Telegraph Company and has become identified with the Consolidated Fuel Company in Salt Lake City, Utah.

E. W. McLennan has been appointed general superintendent of the city and provincial traffic department of the Manitoba government telephone system. Mr. McLennan was formerly with the Bell Company in Orillia, but four years ago entered the service of the Manitoba government with headquarters at Winnipeg.

W. C. Van Sant, who has represented the Chase Motor Truck Company for several years past in the capacity of western traveling salesman, has lately been made district manager for the Pacific Coast. His headquarters will be in Los Angeles, Cal. Mr. Van Sant is one of the best known motor truck salesmen in the United States. For many years previous to the introduction of power wagons, he represented leading carriage and vehicle concerns and is familiar with trade conditions and needs in every section of the country.

Otto Wettstein, of Laporte City, Ia., who recently disposed of his controlling interest in the Jones County Telephone Company, is looking after the interest of his large tracts of land in Florida, which land he received from a Minneapolis land concern, in exchange for his telephone stocks.

E. E. Wilson, connected with telephone management for the Wyoming district, with headquarters in Cody, paid an official visit of several days to Thermopolis, recently.

A. B. Greene, traffic superintendent of the Missouri and Kansas Company, spent several days in Topeka, last month, in a successful effort to locate the cause of the telephone trouble in that city.

Frank L. Beam of Mt. Vernon, O., representative of the independent telephone interests of the state, held several conferences in September with telephone men of Columbus, while on a visit to that city.

W. H. Scott, former local manager of the Bell Telephone Company, of Montreal, has been appointed general agent for the Manitoba government telephone commission. Mr. Scott resigned from the Bell Company on account of ill-health, but two years ago entered the service of the Manitoba government telephone department.

C. E. Hickman, district commercial superintendent of the northern division, the Pacific Telephone and Telegraph Company, has completed a month's visit to Chicago, New York, Boston and other eastern points of interest. He was accompanied by Mrs. Hickman.

E. P. Johnston has become assistant secretary of the British American Construction Company in preference to retaining the commercial managership of the British Columbia Telephone Company.

F. H. Hicks, of New Orleans, is the new manager of the Laurel, Mississippi, exchange.

R. M. Porter, of the local plant department at Knoxville, Tenn., has been appointed chief clerk to the district plant foreman.

J. A. Farley of Wilmington, N. C,. is now with the Cumberland Telephone and Telegraph Company, as district plant foreman for the Chattanooga, Tenn., district.

John E. Boisseau now occupies the position of manager of the sales, advertising and general publicity departments of the Chesapeake and Potomac Telephone Company at Baltimore, Md. He was formerly district advertising manager of the New York Telephone Company at Albany, N. Y., and his new position is in the way of advancement.

Homar Jolly, of Duncan, Miss., has assumed the duties of assistant manager at the Hickman, Ky., exchange of the Cumberland Telephone and Telegraph Company. He succeeds J. N. Tunes who also was promoted.

T. C. Vaiden is another Bell Telephone Company man of Richmond, Va., who has been promoted recently. Mr. Vaiden's appointment is to the position of district plant chief.

L. Madison is the new manager of the Tri-State Telephone Company of Faribault, Minn.

W. M. Anderson of Topeka, Wash., manager of the telephone company with headquarters at Rosalia, has applied for a ten-year local franchise.

Ben Kerskamp of Plymouth, Wis., has been elected to fill the vacancy of manager of the local telephone exchange, Edward McCormick, former manager, resigned.

S. L. Von Almen, has resigned the position of manager of the local telephone company of Waupaca, Wis.

Don Aird is successor to W. J. Lindsey, as manager of the New Union Telephone Company of Dodgeville, Wis.

George McShane has been named manager and J. E. Smith, secretary of the new Ross Telephone Exchange, at Ross, N. D.

G. H. Belcher has been elected president and L. H. Box, secretary and treasurer of the Mutual Telephone Company at Lavina, Mont.

Chester Stratton succeeds his father, deceased, as local manager of the Mississippi Valley Telephone Company at Nauvoo, Ill.

General manager Eby and A. N. Huckins of the Rockford plant of the Central Union Telephone Company held a conference, with the officers of the company as their guests, with a view of rebuilding the equipment that connects the towns in northern Illinois. The visiting officers were: C. H. Rottger, Springfield, commercial superintendent for Illinois; S. J. Larned, Chicago, assistant to the general manager; W. B. Abbott, general commercial superintendent; L. Redmond, Chicago, general plant superintendent; W. R. McGovern, Chicago, engineer.

Patrick O'Day is the new president of the Peoples' Telephone Company at Rock Island, Ill. W. J. Graham was named vice-president and Emil A. Anderson was re-elected secretary and treasurer. A. B. Cole and J. A. Wells are new directors.

D. F. Turnbull, local manager of the Bell Company at Birmingham, Ala., has been notified by W. T. Gentry, president of the company, with headquarters at Atlanta, that everything possible for the improvement of the Birmingham service will be done.

G. G. James has been appointed temporary manager of the Southern Bell Telephone Company, with offices in Suffolk, Va., and it is thought the appointment will be made a permanent one. Mr. James is filling the position left vacant by the resignation of W. B. Ferguson.

E. F. Garratt, district manager of the Cumberland Telephone and Telegraph Company, has announced the success of the meeting of the chief toll operators at Knoxville, Tenn. The meeting was the first of its kind ever held in Knoxville and among the telephone officials present, were: W. A. Brennon, O. S. Bridges, K. C. Hardcastle and W. K. Boardman.

Harry DeLashmutt has purchased the telephone plant at Pocahontas, Ill.

J. H. Richardson, formerly manager of the Sun Telephone & Telegraph Company at Selmer, Tenn., has been transferred to a similar position at Lexington, succeeding Joe. A. Carpenter, who has been transferred by the company to Corinth, Miss. Mr. Carpenter has been with the Sun Company since its advent into Lexington, and is held in high esteem.

Samuel Sutter and Frank Gahagan were the new directors elected at the annual meeting of the Cooksville Telephone Company officials, at Cooksville, Ill.

Gill Edwards has received the appointment of manager of the Christian-Todd Telephone Company at Pembroke, Ky. He

was line chief for several years for the Pembroke Home Telegraph Company.

E. E. Bawsel, special agent to the general commercial superintendent of the Southern Bell Telephone Company at Atlanta, Ga., has been appointed superintendent of the Georgia division, to succeed W. B. Roberts, who died a few weeks ago. Mr. Bawsel has been connected with the company for 34 years, entering as operator in Washington in 1878. He was rapidly promoted, and for a time was manager of the Savannah exchange. From 1901 until 1911 he was superintendent of the Southern division of the American Telephone Company, with headquarters in Atlanta. In April of last year he became special agent to the general commercial superintendent. He was acting superintendent throughout the illness of Mr. Roberts and is thoroughly familiar with his duties. Mr. Bawsel has made his home in Atlanta for many years.

Vergil King is successor to W. H. Maberry as local manager of the Mississippi Valley Telephone Company at Hamilton, Ill. Mr. Maberry has advanced from the position of local manager at Hamilton, to that of superintendent, with headquarters at Carthage.

Edward C. Fitzgerald and J. B. Ware have resigned from the directorate board of the Citizens' Telephone Company at Grand Rapids, Mich. Mr. Fitzgerald was vice-president as well as director but ill health prompted his resignation.

Al Fleshman has been given charge of the telephone system in Wilcox, Ia.

H. D. McVey has relinquished the position of district manager for the Mountain States Telephone and Telegraph Company at Tucson, Ariz., and has entered upon the duties of special agent which will take him to all portions of Arizona.

J. P. Armstrong has succeeded J. H. Moore as manager of the local telephone company at South Pittsburg, Tenn.

Manager P. P. Anderson of the Home Telephone Company of Waukegan, Ill., has completed a tour of inspection among modernly equipped telephone buildings in the eastern part of the state. As a result he has advanced many helpful suggestions as to the equipping of the company's building now being erected.

P. C. Gettins of the Sterling section of Colorado, has received the appointment of district manager of the Mountain States Telephone and Telegraph Company, with headquarters, which may be temporary, at Tucson, Ariz.

T. R. Gentry, for several years with the Southern Bell Telephone & Telegraph Company as chief clerk to Division Superintendent Morgan B. Spier, at Charlotte, N. C., has received notice of his promotion to the office of special agent of the commercial agent with headquarters in Atlanta. Mr. A. E. Waltman, who has been with the company for a number of years, will come to Charlotte to take Mr. Gentry's place.

Floyd N. Dull, secretary and purchasing agent for the Home Telephone Company at Detroit, Mich., for the last several years, has received the appointment of general manager for the Valley Telephone Company properties which are at Saginaw, Bay City and other neighboring small towns. His extensive experience with the telephone business will be of much practical assistance to Mr. Dull in his new office.

The following district managers and department heads of the Inter-State Telephone and Telegraph Company held a recent meeting at the Aurora, Illinois, office and discussed plans for making a campaign for new business in each city of their territory and for rebuilding the plants and regarding improved service: L. C. Griffiths, general manager; G. J. Beverly, auditor; H. B. Crandall, engineer; J. A. Seals, traffic engineer; L. A. Rudd, traveling auditor; C. R. Peel, superintendent, and the following district managers; E. T. Teece, Peoria; H. E. Jeffreys, Aurora; J. F. Parsons, Joliet; George Galloway, Elgin; E. B. Marmaduke, Sterling; George H. Annan, Springfield.

T. P. Barnard was elected president of the Omer Telephone Company, at a meeting of the company held Sept. 21 at Fowler, Colorado. He succeeds R. E. Rickstrew, resigned.

E. H. Lawson, who has been at Galveston, Texas, for the last two years, as an official of the Southwestern Telephone Company, has been transferred to Dallas.

Brown and Hopkins, practicing patent and trade-mark law, with offices in the Monadnock building, Chicago, have added two new members to the firm. They are Charles M. Nisson and Arthur L. Sprinkle. Both have been with the firm for several years. The firm will hereafter be known as Brown, Hopkins, Nissen and Sprinkle.

Mathias Kondolf, father of Frank N. Kondolf, president of the Stromberg-Carlson Telephone Manufacturing Company, died recently at his home in Rochester, N. Y., in which city he had spent seventy-five years of his life. He was born in Merlinbach, Germany, in 1835, and came to Rochester at the age of two years. He was one of the city's most active citizens.

H. D. Kamps, of Houston, Texas, is the new manager of the Southwestern Telephone Company at Rockdale.

M. N. Goodson has resigned the managership of the telephone company at Guthrie Center, Ga., and has accepted the management of the telephone company at Williamsburg.

C. L. Miller is the newly appointed district manager for the Wisconsin Telephone Company, of the re-established Janesville districts of the lines in Rock, Iowa, La Fayette and Green counties. Mr. Miller has been manager of the Janesville office for more than a year.

Arthur D. Wheeler, former president of the Chicago Telephone Company and member of the law firm of Holt, Wheeler & Sidley, died suddenly Aug. 30, at his home at Lake Forest. His death was caused from heart trouble and came after but a short illness. He was born in Kenosha, Wis., in 1861, educated in Lake Forest University, and was admitted to the bar in Wisconsin. In 1882 he located in Chicago, entering the office of Williams & Thompson. He was admitted to a membership in this firm in 1886, and later the firm was changed to Holt, Wheeler & Sidley. He was made a second vice president of the Chicago Telephone Company and later became its head. He also held positions as attorney for the Elgin, Joliet & Eastern Railway Company, and for the Santa Fe road. He was a member of the Chicago and University clubs and was a trustee in the Presbyterian hospital. At the time of his death he was chairman of the board of directors of the Chicago Telephone Company.

Francis I. Daly has been elected assistant secretary and assistant treasurer of the Bell Telephone Company of Pennsylvania and its associated companies. He succeeds the late W. C. Funk.

Thaddeus S. Lane, president of the Home Telephone Company, has been chosen president and treasurer of a company formed to develop a 22,000-acre ranch forty miles west of Kalispell, Mont. The company is known as the Pleasant Valley Ranch Company and is capitalized at $500,000. "The ranch is a hay and stock farm," stated Mr. Lane. "There are about 1,000 head of cattle on the place, but this number will be increased immediately to approximately 5,000. George S. Doll, of Helena, is secretary of the company."

J. W. Warwick is the Carthage, Ill., local manager of the Mississippi Valley Telephone Company.

W. L. Van Camp has received the appointment of district manager of the Northwestern Telephone Company. His headquarters are at Owatonna, Minn.

Dr. Frank S. Wade succeeds L. A. Baker to the presidency of the St. Croix Telephone Company at River Falls, Wis.

F. G. Hartzell has been appointed district manager of the Nebraska Telephone system in the Black Hills.

William H. C. Phillips, of Honeoye Falls, formerly of Canandaigua, has been appointed manager of the Le Roy exchange, N. Y.

After serving but a few months as manager of the Cumberland Telephone Company, at Georgetown, Ky., F. J. Gorham has been transferred to Lexington. His position will be filled by Dennis Mulligan, of Lexington. A large number of men have been promoted from Georgetown to larger cities within the past two years.

N. T. Guernsey, of Leon, Ia., has gone to New York as head of the legal department of the American Telephone and Telegraph Company. He will also have charge of some of the legal affairs of the Western Union Telegraph Company.

D. Y. Craddock, manager for the Southwestern Telephone Company, of Ennis, Tex., has tendered his resignation and will be succeeded by A. Rooper, of Frost.

H. M. Fennemore, in his new position as chief of the publicity department of the Mountain States Telephone and Telegraph Company, has his headquarters at Denver, Col.

Charles A. Grant, assistant secretary of the Western Union Telephone and Telegraph Company, has been given a similar position with the American Telephone and Telegraph Company.

John Balch has assumed the duties of assistant secretary of the American Telephone and Telegraph Company. He formerly held a like position with the Western Telephone and Telegraph Company, of Boston.

Angus S. Hibbard, after a good time vacation at Kineo, Me., is again busy in the executive department of the American Telephone and Telegraph Company, New York.

Stanley J. Goddard, president of the Constantinople Telephone Company (Societe Anonyme Ottomane des Teléphones de Constantinople), and W. W. Cook, consulting engineer, left London reecntly by the Orient Express on a visit to Contantinople.

W. R. McGovern, formerly engineer of the Wisconsin Telephone Company, and for the past year engineer of inventory and

appraisals for the Central Group of Bell Companies, has been appointed engineer for the state of Illinois, covering all the property of the Chicago Telephone Company and the Central Union Telephone Company in Illinois, that state being the largest unit of the Central Group.

I. H. Gaither, who has been the local manager for the Mountain States Company since it took over the telephone business at Lewistown, Mont., has sent in his resignation and will retire from the position as soon as a new manager is selected. Mr. Gaither will probably continue to reside in Lewistown.

Louis B. Eaton, who for the past ten years has been the local manager of the Federal Telephone exchange in Le Roy, N. Y., has been appointed manager of the Hornell exchange. This is a promotion for Mr. Eaton, as the Hornell exchange is much larger, having about 2,000 subscribers.

John H. Richardson, local manager of the Sun Telephone and Telegraph Company at Selmar, Tenn., has been appointed district manager, with offices in Lexington, Tenn. Arnold T. Fulghum, of Selmar, succeeds Mr. Richardson as manager at Selmar.

Frank O'Neill, who was formerly associated with the Pacific Telephone and Telegraph Company, has been appointed to the newly created position of electrical engineer of the Bureau of Fire Alarm and Police Telegraph of Los Angeles, Cal. The appointment has been confirmed by Mayor Alexander and the city council.

M. H. Driftmier has been retained as manager of the newly merged local Bell lines and the Independent Mutual Telephone Company, of Shenandoah, Iowa.

George H. Black has been promoted to the newly created position of contract manager for the Bell Telephone Company at Richmond, Va. He will have charge of much of the local work formerly performed by Albert S. Tanner, district commercial manager. The extensive growth of Mr. Tanner's district made necessary the appointment of a district manager. Mr. Black has been employed in the contract department for the last seven years.

Frank Grehouse, of Cedar Rapids, Iowa, has been assigned the position of resident lineman at Dubuque, by the Pitcher Telephone Company.

Levi Baker will continue as president of the Independent Mutual Telephone Company at Shenandoah, Iowa, with which company the local Bell lines have recently merged.

Alexander Graham, Richmond, Va., has received the appointment of revenue supervisor for the Bell Telephone Company. The position has been recently created and Mr. Graham's appointment was in the way of a promotion. He will have charge of all accounting and billing for all the Bell exchanges in the state of Virginia and will report to the general auditor of the company at Batimore.

Among the newly elected associate members of the American Institute of Electrical Engineers, are: George William Dickerson, engineer, Telephone Improvement Company, Cleveland, Ohio; Thomas H. Nicholson, switchboard engineer, engineering department, Bell Telephone Company, of Canada, Montreal, Canada; Patrick Henry Skahill, plant superintendent, Hawkeye Telephone Company, Des Moines, Iowa; Yoshihiko Takata, telephone and telegraph engineer, department of communication, Japanese government, Tokio; Earl Roy Neir, chief installer, Automatic Electric Company, Chicago, Ill.

James W. Harrison, of Walhalla, S. C., has been appointed manager of the Colleton County Telephone Company. Mr. Harrison is a graduate of the electrical and engineering course of Clemson College, where, for the past year, he has been assistant director in the electrical department, and has had charge of the power plant and the electrical and telephone systems.

C. W. Moody, of Cleveland, Ohio, has recently severed his connection as district manager for the Chase Motor Truck Company, of Syracuse, N. Y. Royal B. Curtiss, of Stepney, Conn., has been appointed in his place. Mr. Curtiss was formerly sales manager of the Royal Equipment Company at Bridgeport, Conn. In his new position he will have the oversight of a territory including Ohio, West Virginia, Kentucky, Michigan and part of Indiana. He will make his headquarters in Cleveland.

J. M. Richardson has been transferred by the Bell Telephone Company from Richmond, Va., where he was district plant chief, to Norfolk, Va.

C. K. Thomas, formerly with the Lukenheimer Company, of Cincinnati, and later with the Best Manufacturing Company, of Pittsburg, Pa., two well known valve manufacturing concerns, is another recent addition to the staff of district managers of the Chase Motor Truck Company. Mr. Thomas in his new capacity will make his headquarters in St. Louis, Mo. He will have Arkansas and Oklahoma.

will have oversight of a territory including Kansas, Missouri, Texas, Arkansas and Oklahoma.

Toledo, Ohio, was married to Miss Tina Rodemaker, of Decatur, Ill., on Wednesday, September 4. Mr. and Mrs. Lattin took a honeymoon trip through the west.

Special Agent Fitzgerald, of the commercial department of the Wisconsin Telephone Company, spent seevral days at De Pere during the past month studying the telephone needs of the city for the future and making plans for the connection of the two systems.

F. W. Nelson, W. B. Woods and Lloyd C. Henning, of Holbrook, Arizona, have purchased from the Mountain States Telephone Company, all telephone lines running from Holbrook southeast through Navajo and Apache counties.

W. A. Gibson has resigned from the Michigan State Telephone Company and has joined the employ of the Michigan Inspection Bureau and Insurance Company, of Detroit.

R. R. Hobbs, chief operator in the telegraph office of the Louisville & Nashville Railroad Company, Louisville, Ky., has been appointed superintendent of the telegraph and telephone system of the company with headquarters in Louisville.

C. D. Thorpe, of Winnfield, La., has assumed charge as local manager of the Southwestern Telegraph and Telephone Company, of Jonesboro, Ark. Heretofore the local work has been in charge of District Manager Roberts, who will now do only district work.

Lamar Tyree, with the Bell Telephone Company at Richmond, Va., has been appointed cashier with entire charge of all collections in the local office together with supervision of collections at the other exchanges in the Richmond district.

Martin Ewald, general installation foreman, was elected, uanimously, to complete the term of plant department governor for the Telephone Society of Michigan. The post has been left vacant by W. A. Gibson, who resigned the telephone business to enter into that of insurance.

Earl S. Taylor, representing the Mountain States Telephone and Telegraph Company, has spent some time at Idaho Falls, Idaho. As a result construction work on the rural lines out of Idaho Falls will be rapidly carried on.

J. J. McCarty, plant chief of the Third Ohio district of the Central Union Telephone Company, has been transferred to Cleveland, where he has assumed the duties of superintendent of construction. He is succeeded by J. A. Bell, of Dayton, who was formerly plant chief in this district.

L. B. Curtis, of Waco, has taken charge of the South Texas Telephone Company at Port Arthur, succeeding George T. Dunaway, who had been in charge of the business there for four months.

James W. Houston, for years wire manager of the Cumberland Telephone and Telegraph Company at Louisville, Ky., has been appointed manager of the McLean county exchanges of the company.

O. C. Walker, who had been manager of the Cumberland telephone office in Johnson City, Tenn., for several months, has resigned to accept the position of manager of the Western Union telegraph office. L. O. Browning's resignation made the position vacant.

W. Roy McCanne, formerly secretary and treasurer of the Stromberg-Carlson Manufacturing Company, has been chosen by the directors of the former company, to take full charge of the liquidation affairs of the telephone manufacturing company for a period of two years. He has resigned from the Eastman Kodak Company and will assume the duties of his new position on October 1.

E. R. Myers, who has been manager of the telephone exchange of Los Animas, Col., for some time, has been transferred to the Lamar office and his place is taken by J. C. Busse, formerly of Rawlins, Wyo.

The following were elected officers of the Twelve Corners-Mackville Telephone Company: President, John Killday, of Center; vice president , E. G. Van Heuklon, of Grand, Chute; secretary, John M. Fassbender, of Black Creek; directors, William F. Wolf, Judge T. H. Ryan, John Parker and Charles Simmers.

Van A. Wallin and Percival B. Garvey were elected to the board of the Citizens' Telephone Company, of Grand Rapids, Mich., to succeed J. B. Ware and Edward Fitzgerald, resigned. The other directors were re-elected as follows: Robert D. Graham, Lester J. Rindge, Gaius W. Perkins, E. B. Fisher, Cyrus E. Perkins, John B. Martin, Philip Graham, William J. Stuart and Charles F. Rood.

H. S. Saunders was elected president; W. D. Burnett, vice president, and L. M. Nance, secretary-treasurer, of the Charles City Telephone Company, Charles City, Va.

J. G. Ihmsen, general manager of the Stromberg-Carlson

Telephone Manufacturing Company, Rochester, N. Y., was in Chicago on business for a few days last week and visited this office.

C. Ella has applied for a concession for installing a telephone exchange in the Argentine Republic.

Manager L. B. Eaton, of the Federal Telephone and Telegraph Company at Le Roy, N. Y., has been promoted to the managerial office of the company's Wellsville and Belmont exchanges.

V. S. McNutt, an experienced telephone man, has been made purchasing agent for the Cracraft, Leich Electric Company of Genoa, Ill.

R. E. Linney succeeds Charles T. Edwards as manager of the Missouri and Kansas Telephone Company with offices at Coffeyville, Kans.

Manager J. A. Carpenter, of the Sun Telephone and Telegraph Company at Lexington, Tenn., has been transferred to Corinth, Miss., and J. H. Richardson, manager at Selmar, Tenn., succeeds him.

NEW TELEPHONE COMPANIES.

Geddes, S. D.—Articles of incorporation have been filed for the Midway Telephone Company at Geddes, with a capital of $1,000, the incorporators being Joe Dagher, John Carda, Victor Montague and George Scherer.

Orange, Tex.—Aupha Turner, a local contractor, completed the work of building a telephone line seventeen and a half miles long for the Orange County Irrigation Canal Company. This system is connected with the Southwestern Telephone system in this city and includes all of the pumping stations as well as residences along the new canal of the above company, as well as the Holland plantations.

Ross, N. D.—The local telephone exchange, which had closed for nearly a year, and which was formerly owned by the Queen City Telephone Company, has been recently purchased by a number of local business men and enterprising farmers. The new telephone company will be known as the Ross Telephone Exchange and is capitalized at $25,000. The board of directors follows: G. McShane, R. H. McEnany, A. H. Gleason, J. E. Smith and Dave McKinnon. George McShane was appointed manager and J. E. Smith as secretary, both to act until the first of the year, when the annual election will be held.

Mildred, Mont.—Mildred Telephone Company, of Mildred, Custer county, has been incorporated by S. A. Souther, of Mildred; F. C. Collins, of Chicago, and G. C. Burge, of Wilmette, Ill. Capital, $5,000, of which $1,500 has been subscribed.

Rushville, Ill.—The Schuyler Telephone Company has been formed, capital, $10,000, to operate a telephone system. Incorporators: Enoch Edmonston, H. B. Anderson, D. E. Haber, C. L. De Witt.

Beach Haven, Pa.—The Salem Hall Telephone Company, of Luzerne county, has been chartered to do business in Luzerne and Columbia counties, with a capital of $5,000. It is composed of members of the various granges in the two counties.

Bloomdale, O.—A mutual telephone company has been organized with Elias Miller, president, and T. A. Rosendale, secretary, and an exchange will be built at Bloomdale.

Preston, Ore.—Citizens of Preston and Dennis are organizing a telephone company.

Arlington, Wash.—The South Ford Telephone Company has been organzed and will build a rural line.

Lansing, Mich.—Pickford Telephone Company has been organized at Chippewa county; capital, $10,000.

Cliffside, Va.—The Cliffside Telephone Company of Cliffside, Rutherford county, is chartered with $10,000 capital authorzed and $1,600 subscribed by R. R. Haynes, Z. O. Jenkins and others, for local and rural exchange service.

Lynchburg, S. C.—A commission has been issued to the Lynchburg Telephone Company, of Lynchburg, with a capital stock of $3,000. The petitioners are H. J. Harby, I. C. Strauss and Robert Shelor.

Cadillac, Mich.—The telephone line in Greenwood township, formerly owned by the Citizens' Telephone Company, has been purchased by a company formed by about thirty farmers. The new company, known as the Greenwood Telephone Company, owns the poles and wires, but must rent the telephone instruments from the Citizens' company.

FINANCIAL ITEMS.

Chicago, Ill.—The Chicago Telephone Company declared a regular quarterly dividend of $2 per share, payable September 30, to stock of record September 21.

Winnipeg.—George A. Watson, formerly of the Tri-State Telephone Company, but now commissioner of the Manitoba government telephone system, has announced the new program. By amalgamating departments and reducing the number of employees, a saving of over $7,000 has been effected, while receipts have been increased by advances in rates. In future all new lines will be built by contract and some 350 miles of rural lines will be added as soon as the work can be completed. Each month a statement of receipts and expenditures will be published and it is said that the system has already been placed on a paying basis. R. L. Barry, of Minneapolis, will be retained on the payroll in an advisory capacity.

Chicago Ill.—The Desplaines Telephone Company, represented by Roscoe B. Wallace, president, has given a trust deed to the Central Trust Company on all its real estate and personal property, as security for a loan of $25,000 for fifteen years at 6 per cent interest.

Animosa, Iowa.—The Jones County Telephone Company has gone into the hands of a receiver. C. B. Paul has been appointed receiver. It is now owned by Minneapolis parties. Helen L. Shaw is the principal bond holder.

San Francisco, Cal.—O. L. Scott and C. W. Eastin, president and secretary of the Municipal Telephone and Anti-Merger League, have filed a petiton with the board of supervisors asking that an election be called early in October for the purpose of voting $6,000,000 bonds for a municipal telephone system.

The earnings of the Pacific Telephone and Telegraph Company continue to increase with each monthly statement. The July gross was $414,964, as compared with $316,946 in the same month last year. For the seven months ending July 31, the comparison is: 1911, $1,646,136; 1912, $2,102,846. Reports of the business of the company state that the number of new connections being made at present is greater than at any period of the company's history.

Austin, Tex.—An increase in its capital stock from $20,000,000 to $100,000,000 is planned by the Southwestern Telegraph and Telephone Company, and it is also proposed to change the name of this company to the Southwestern-Bell Telephone Company. It is expected that the company will make material improvements in its system in the state of Texas.

Frankfort, Ky.—The Prestonburg & Hindman Telephone Company has filed amended articles of incorporation in this city authorizing an increase in capitalization from $4,500 to $12,000 and including the operation of a telegraph system in its business.

Prestonburg, O.—Prestonburg and Hindman Telephone Co. has been authorized to add telegraph lines to its corporation powers and increase its capital from $2,400 to $12,000.

Grand Rapids, Mich.—The annual reports of the Citizens' Telephone Company, of Grand Rapids, Mich., show gross earnings, $767,368.04; dividend disbursements, $295,588.17; operating maintenance and depreciation, $441,757.57, and general expense, interest and taxes, $30,022.30. The net earnings were all put into reconstruction and depreciation and the amount so disposed of was $29,000 more than last year, and last year the net was the largest in the history of the company.

Boston, Mass.—The directors of the American Telephone and Telegraph Company have declared the regular quarterly dividend of 2 per cent, payable October 15 to stock of record September 30.

Atlanta, Ga.—While attorneys were arguing the decree that is to be rendered in the suit of the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., against C. J. Simmons, United States Judge William T. Newman made it plain that he will authorize the Stromberg-Carlson Company to foreclose on certain securities of the Atlanta Telephone Company as a means of collecting $139,921.57 that is owed to the company by Mr. Simmons. This stock is a major part of the securities of the Atlanta Telephone Company, and the possessor of it will be the principal stockholder in the company. But it is said that the debt to the Stromberg-Carlson company will be paid without the necessity of foreclosure and that the securities for the debt of $139,921.57 will not pass into the possession of the Stromberg-Carlson company. No definite announcement has been made of how Mr. Simmons will dispose of his stock.

Rochester, N. Y.—After a meeting of directors of the Stromberg-Carlson Telephone Manufacturing Company, announcement was made by President Frank N. Kondolf that the board had declared a dividend of 10 per cent on the preferred stock, payable October 8. Books closed September 26. The dividend will call for the distribution of $150,000. This is the second dividend toward liquidating the par value of the preferred stock that has been declared by the directors.

Harrisburg, Pa.—The Lower Saucon Telephone Company, of Hellerstown, has filed notice of increase of debt from $15,000 to $25,000.